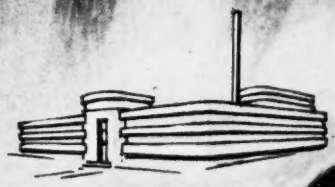
ONE DOLLAR

OCTOBER 1953

FOOD ENGINEERING



1978

ENGINEERING REVOLUTIONIZES FOOD MANUFACTURE

1928

25th ANNIVERSARY ISSUE

A McGRAW-HILL PUBLICATION

What valve would you specify?

Alcohol

Citric Acid

Vinegar

Fruit Juices

Glucose

THE NEED!

A valve to handle these typical liquids in food processing

Beer

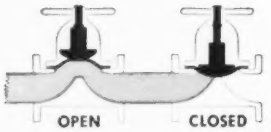
Mash

The seven liquids cited above give dramatic emphasis to the all-around versatility required of a valve in the food field.

Grinnell has a valve that "fills the bill"... the Grinnell-Saunders Diaphragm Valve. Although employing only a single basic design, this unique valve provides a wide choice of body, lining and diaphragm materials.

To illustrate, for use on lines handling vinegar, stainless steel Grinnell-Saunders Valves equipped with butyl diaphragms are available. For handling beer, polished bronze valves are recommended with special white diaphragms which impart no taste or color to beer and are unaffected by caustic soda or steam cleaning.

The amazing adaptability of the Grinnell-Saunders Diaphragm Valves in handling highly corrosive fluids, gases, compressed air, beverages, foods and suspended solids... in lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors... explains its acceptance by industry after industry. For further details, write for Grinnell-Saunders Diaphragm Valve Catalog.



Features which have made Grinnell-Saunders Diaphragm Valves the specified valve in many different industries:

Streamlined flow. Smooth, streamlined passage, without pockets. Frictional resistance at a minimum.

Leak-tight closure against grit, scale, suspended solids.

Working parts absolutely isolated from fluid. Diaphragm completely seals off working parts from fluid in the line.

Body, lining and diaphragm materials to meet service condition. Bodies stocked in cast iron, malleable iron, stainless steel, bronze and aluminum; other materials on special orders. Valve bodies lined with lead, glass, natural rubber or neoprene. Diaphragm materials of natural rubber or synthetics.

Minimum maintenance. No refacing or reseating is required. No packing glands to demand attention. New diaphragm can be inserted without removing valve body from the line.

GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • **Coast-to-Coast Network of Branch Warehouses and Distributors**

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

Food Engineering

Vol. 25 • OCTOBER, 1953 • No. 10

25th Anniversary

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FOOD ENGINEERING
(Formerly Food Industries)
October 1953 Vol. 25, No. 10
Member ABC and ABP

Published Monthly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. **Publication Office 99-129 N. Broadway, Albany 1, N. Y.**

Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New York, 36, N. Y. Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President & Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Div.; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President & Director of Advertising; J. E. Blackburn, Jr., Vice-President & Director of Circulation.

Subscriptions: Address correspondence to Food Engineering—Subscription Service, 99-129 N. Broadway, Albany 1, N. Y. or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.

Subscriptions are solicited only from the executives, engineers, and technologists in food processing plants. Position and company connection must be indicated on subscription orders.

Single copies 35c. Subscription rates—U. S. and possessions $2 for 1 yr., $3 for 2 yr., $4 for 3 yr. Canada, $3 for 1 yr., $4 for 2 yr., $5 for 3 yr. Other Western Hemisphere countries $10 for 1 yr., $16 for 2 yr., $20 for 3 yr. All other countries, $15 for 1 yr., $25 for 2 yr., $30 for 3 yr. Entered as 2nd class matter Aug. 26, 1948, at Post Office at Albany, N. Y. under Act of Mar. 3, 1879. Printed in U.S.A. Copyright 1953 by McGraw-Hill Publishing Co., Inc.—All Rights Reserved.

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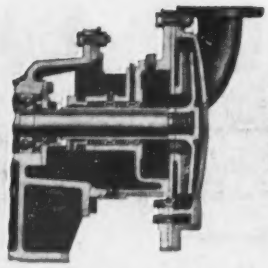
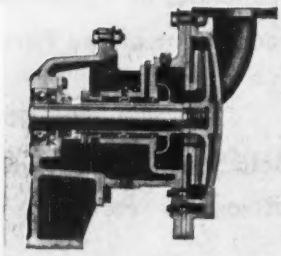


Standard Stuffing Box — for suction lift. Stuffing box on the suction side limits pressure on packing to suction pressure. Under suction lift conditions, the liquid being pumped does not enter the stuffing box.

ALLIS-CHALMERS

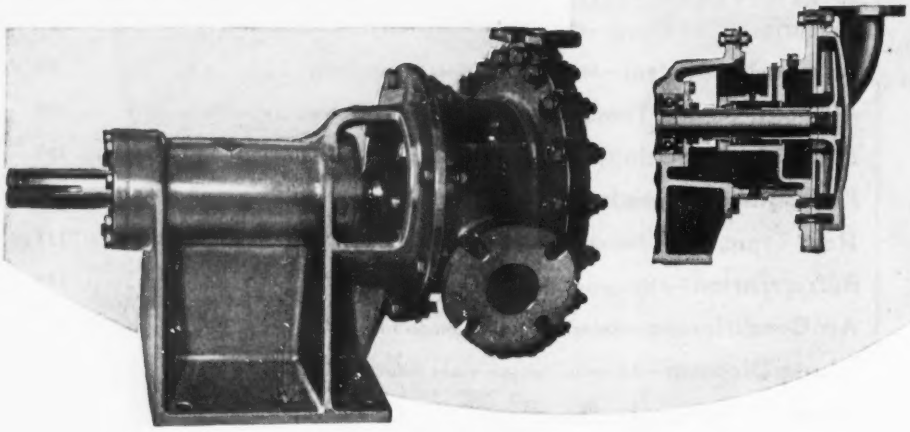
PROCESS PUMPS

VERSATILITY that Cuts Your Pumping Costs



***Equiseal* Stuffing Box — for suction heads to 15 feet.** The *Equiseal* stuffing box is equipped with an auxiliary impeller which produces a low pressure area in front of the packing. This low pressure area prevents the liquid being pumped from entering the packing on suction heads up to 15 feet at 1750 rpm.

Mechanical Seal — for suction heads over 15 feet. The Allis-Chalmers Process Pump may be fitted with a variety of mechanical seals for conditions where the suction head exceeds 15 feet. Each application is individually engineered.



YOU CAN HANDLE A WIDE RANGE of products with one type of pump when it is an Allis-Chalmers Type P Process Pump. Each of the three sealing methods shown here is interchangeable on any Type P pump with a minimum of alteration to the pump itself. No new major parts or permanent alterations are required to use any of these sealing methods.

CHOICE OF MATERIALS

The Allis-Chalmers Process Pump is available in a wide choice of materials to handle many combinations of abrasiveness and corrosiveness in the liquid to be pumped. Usual materials include aluminum bronze, *Ni-Resist*, 316 stainless steel, and 18% chrome steel, plus almost any special material which may be required, including non-machinable alloys. Parts subject to varying rates of wear are separated for easy replacement.

GET DETAILS

For complete details on the Allis-Chalmers Process Pump plus competent engineering assistance, call your nearby Allis-Chalmers District Office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin 52B6615. A-3902

Equiseal is an Allis-Chalmers trademark.

ALLIS-CHALMERS

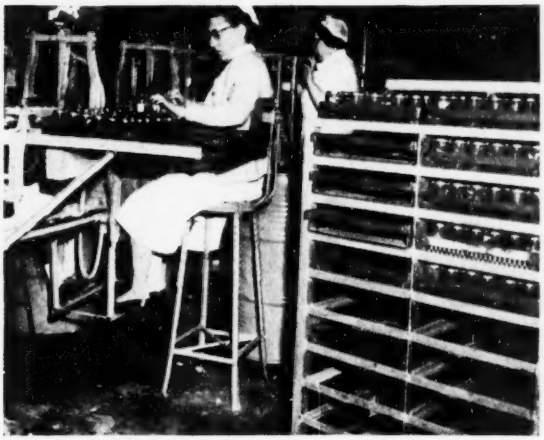
BIG ANNIVERSARY ISSUE—PLUS DEPARTMENTS

To climax 25 years of technical service to the food manufacturing industry, FOOD ENGINEERING has prepared this fact-packed 25th Anniversary Issue. It contains no less than 25 feature articles, each representing the results of many months of preparation.

Despite the unusually large quantity of feature material, this issue also carries the regular departments.

Three are in shortened form. But next month there will be the usual five pages of Practical Ideas, ten of New Equipment & Supplies, and three of New Packages & Products department.—THE EDITORS

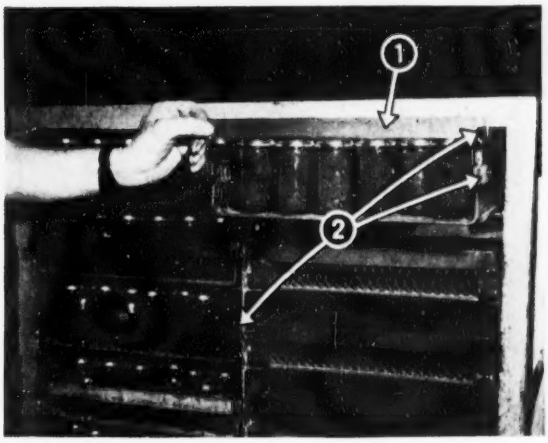
PRACTICAL IDEAS



Mobile Tray-Rack Avoids Jar Damage

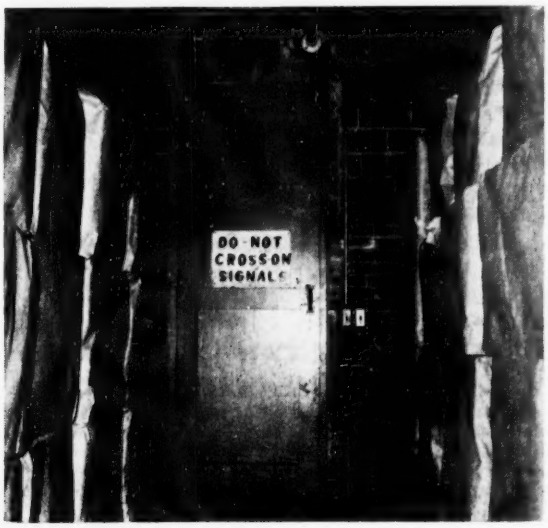
Loss of product due to dropping and smashing was excessive until we designed and built a special system of handling jars of infant food returned for cleaning and relabeling.

Provided were 3-sided trays (see left photo) made of expanded metal, in each of which operator can stack 36 jars removed from labeling line.



Fourth side of each tray is closed by removable bar—(1) in right photo—held in place by interlocking slots (2).

Mounted on casters, angle-iron racks are employed for supplying trays at label-inspection station, for collecting filled trays and for safe transportation to relabeling operations. Here jars can be rapidly and safely slid from each basket by removing metal stop and tilting container.—*Isadore Silveria, Ralph Cross and Anthony Aloi, Gerber Products Co., Rochester, N. Y.*



Lights Warn When Train's in Plant

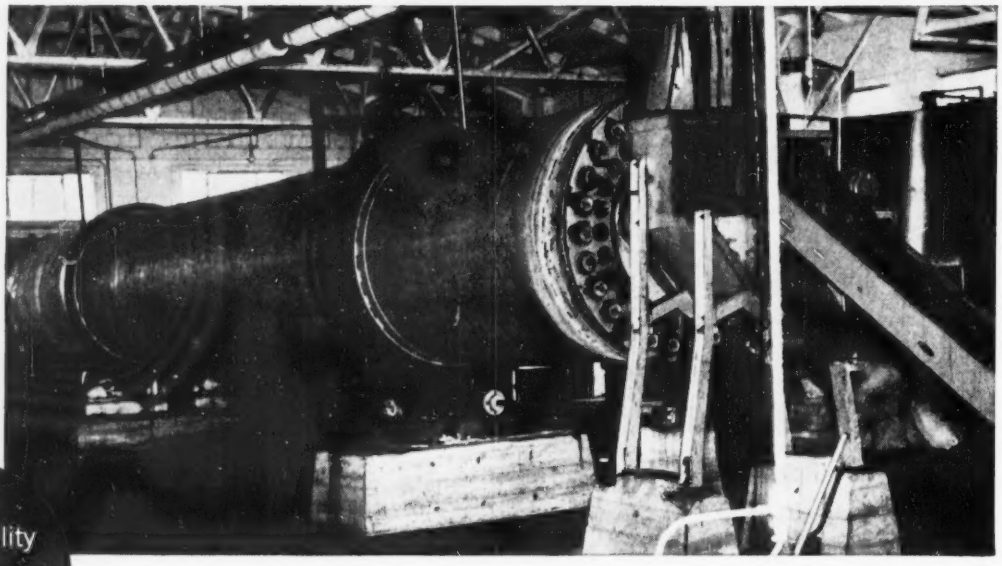
To safeguard against accidents to foot traffic crossing loading dock tracks which are located between two sections of our plant, a unique warning system has been installed. Throughout a long period of use its worth has been thoroughly established.

Rail-dock siding is closed by a wire gate between two buildings where railroad's spur track leads into plant yards. Trainmen must open this gate before engine or cars can enter. Swinging gate closes switch of an electric circuit which leads to a series of warning lights on outside of track-facing buildings and also to red lights inside buildings, located above every door (see photo) that opens onto yard area.

Not only do lights protect employee safety by warning when a train is operating in the plant yard, but they also check on negligence of train crews. Should latter fail to close gate when train leaves plant yard, lighted bulbs are telltale informers.—*A. W. Machamer, Chief Engineer, Chef Boy-Ar-Dee Div., American Home Foods, Inc., Milton, Pa.*

Louisville method doubles your cooking capacity—

cuts your costs in half



for dependability see General American

creative engineering design construction installation

A single Louisville Steam Tube Dryer has doubled the efficiency of this modern rendering plant*. It now discharges the offal from several "batch" cookers in less than half the normal cooking and drying time.

The Louisville method has also helped this plant reduce its unit cost and increase its efficiency in these ways:

- Less total electricity required.
- Motor maintenance and replacement reduced.
- Less total steam required.
- Less maintenance and increased life for "batch cookers" by discharging the material before it becomes gluey and abrasive.
- Same labor handles additional capacity.
- Stack odors slight and easily controlled if necessary.
- Stack odors slight and easily controlled if necessary.
- Operates efficiently on all kinds of offal, blood, cracklings, steep water and manure.

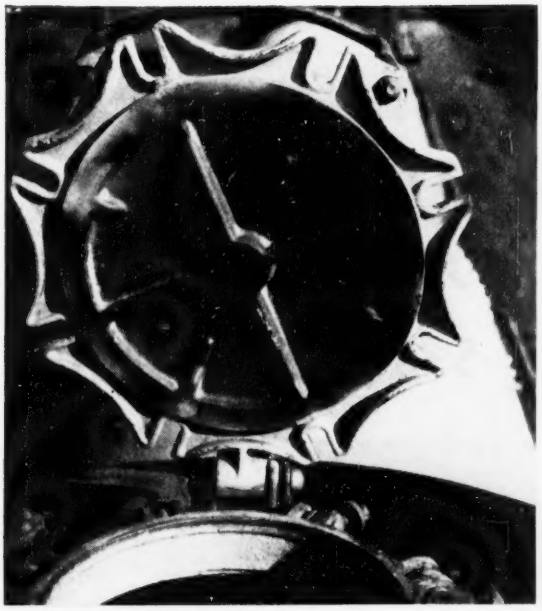
Let us send an engineer to help you make these savings, too.

PROCESS EQUIPMENT DIVISION GENERAL AMERICAN TRADE MARK

LOUISVILLE DRYING MACHINERY UNIT
Over 50 years of creative drying engineering

*Name on request

GENERAL AMERICAN TRANSPORTATION CORPORATION
Dryer Sales Offices: 139 South Fourth Street, Louisville 2, Kentucky
General Offices: 135 South LaSalle Street, Chicago 90, Illinois
In Canada: Canadian Locomotive Company, Ltd., Kingston, Ontario
OFFICES IN ALL PRINCIPAL CITIES
Other General American Equipment: Turbo-Mixers • Evaporators Dewaterers • Towers • Tanks • Filters • Pressure Vessels.

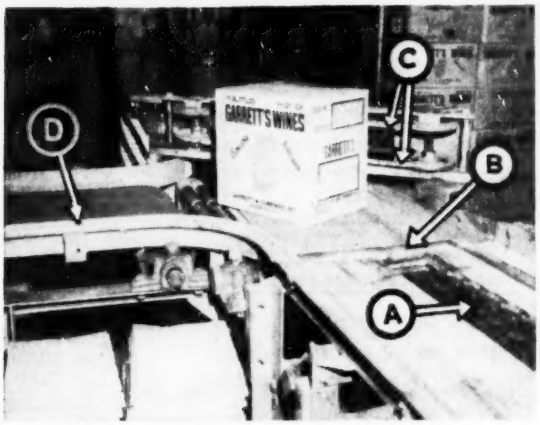


Tank Car Dome-Covers Rubber Lined

To prevent rusting on underside of dome covers on tank cars, conveying shipments of corn syrup, a variety of procedures were tried. Following method proved most efficient and was adopted:

Bottom side of covers were milled, and lined with rubber. (See photo)

This rubber lining not only precludes possibility of rust but also serves as a seal, eliminating need of gaskets.—*F. E. Staff.*



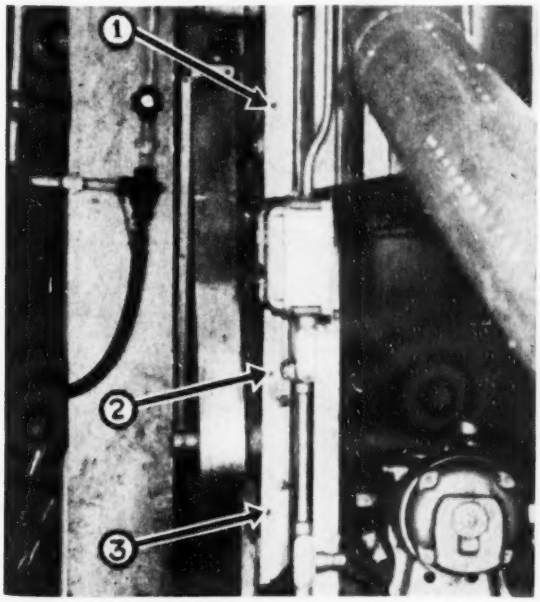
Improved Right-Angle Case Transfer

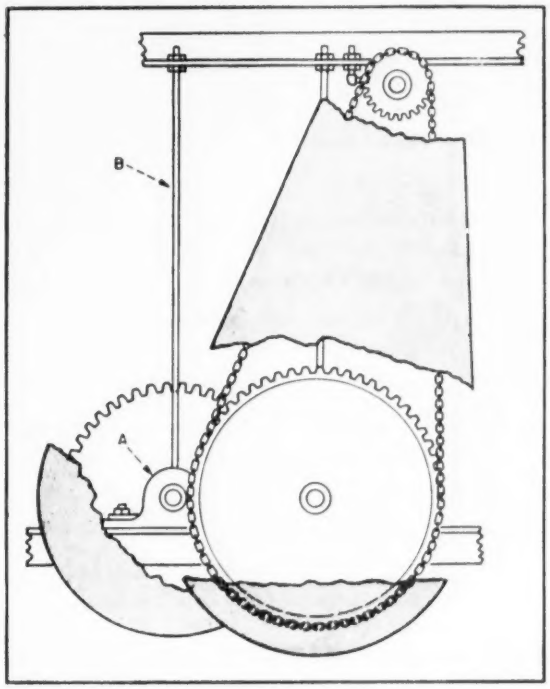
Diverting heavy cartons of wine from one conveyor to another traveling at right angles too frequently resulted in case damage until we cushioned the transfer operation against a pair of moving V-belts.

From case sealing, cartons now travel by chain conveyor—(A) in photo—to diverting station, where transfer is made to a short belt conveyor (B). Pivoting cases against belt does not have the ill effect that resulted from rotating them on the chains.

Forward travel of cases on this intermediate conveyor is interrupted when cases are cushioned against diverter (C), consisting of V-belts running at a 45 deg. angle across the belt conveyor.

Since speed of V-belts is greater than that of the belt conveyor, cases are rapidly rotated counter-clockwise onto conveyor (D) traveling at right angles. Transfer is made without case damage.—*Thomas Bowles, Plant Superintendent, Garrett & Company, Inc., Brooklyn.*



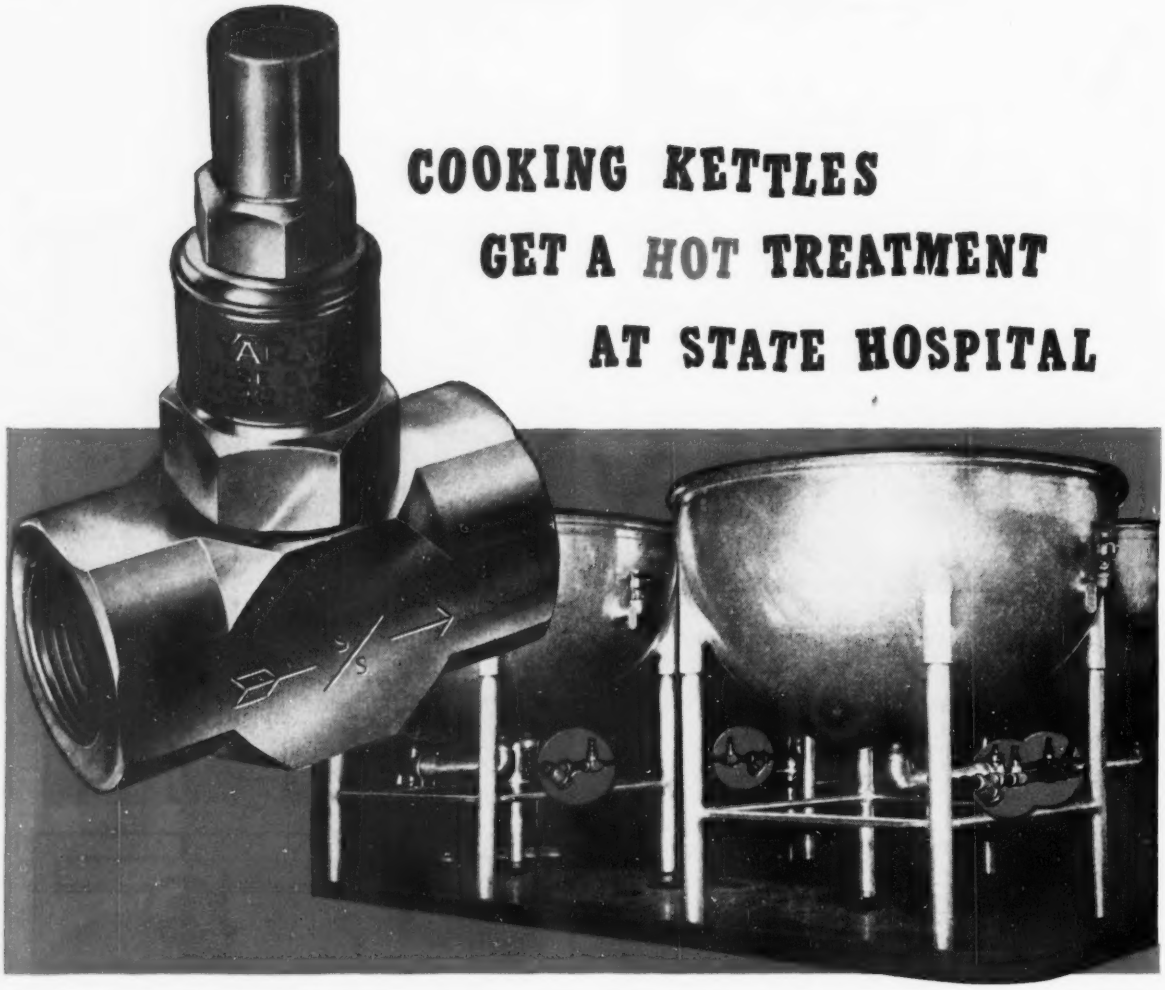


How to Lubricate Hidden Bearings

Installation of a few lengths of metal tubing has made it easy to lubricate otherwise inaccessible bearings on our steam blancher drive shafts.

Efficient layout of our plant production line called for

COOKING KETTLES GET A HOT TREATMENT AT STATE HOSPITAL



Yarway Impulse Steam Traps have put new life in many a "sick", sluggish cooking kettle. In fact, they are "good medicine" for the profitable operation of steam equipment of all kinds because they get equipment hot in a hurry and keep it hot!

At the installation pictured above, in the kitchen of North Carolina State Hospital, Yarways have been doing a good job for over 10 years. Besides quick heating and sustained efficiency, the plant engineer reports "little if any service required."

Other Yarway features are small size, easy installation, light weight, stainless steel construction, only one moving part, good for all pressures.

When you consider that new Yarway Impulse Traps often cost no more than repairing ordinary steam traps, it makes them a doubly good investment.

See the nearest of more than 200 Industrial Distributors who stock and sell Yarways. For free 20-page Trap Selector write . . .

YARNALL-WARING CO. • 127 Mermaid Avenue, Philadelphia 18, Pa.

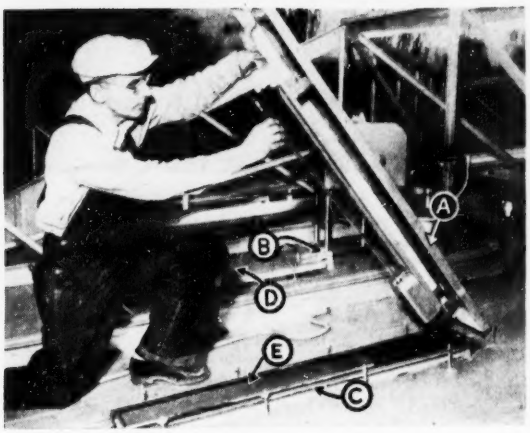
YARWAY

the steam trap designed with more production in mind

For more information, use coupon on page 207.

placing the blancher flush with an upright building support (see photo). But position of girder and safety guard made it almost impossible to apply grease to the bearings—(A) in sketch (where vertical support is at top).

However, lubrication became easy when the standard hydraulic gun nozzles, used to lubricate the bearings, were replaced by threaded tubing (B) screwed into the grease holes. Tubes were extended through holes in an angle iron blancher support and lock nut anchored. Then grease gun nozzles (1, 2, & 3) were attached to tube ends to make it simple to lubricate any of the concealed bearings—*L. M. Jordan and Dorsey Davis, Phillips Packing Co. Inc., Cambridge, Md.*



U-V Lamps Replaced From Tank Roof

Providing 100,000 gal. liquid-sugar storage tanks, at Crockett plant of California & Hawaiian Sugar Refining Corp., with adequate protection from surface contamination was a difficult task before ultraviolet sterilizing lamps were made accessible from tank roof.

So long as surface of liquid sugar was protected, contamination of the syrup was unlikely, and so long as 112 u-v lights (see top photo) in tank dome functioned efficiently, surface contamination was improbable.

However, should some lamps fail or decline in intensity, early replacement was necessary to maintain a safe level of protection. This required frequent inspection of lamps and checking with u-v light meters—an impractical operation were it not for the special C&H-built sterilizing lamp fixtures which are accessible from top of tank.

Lamp fixtures, mounted on metal supports—(A) in second photo—are fitted to tank top by elevated hinges (B). Housing (C), through which lamp projects into tank, is raised several inches above roof surface to provide weather protection by overlapping of lid. Latter is secured when in place by steel straps—seen on the closed unit at (D). As noted, these straps are tightened by wing-nuts.

To prevent passage of contaminated air into tank, a gasket (E) provides a hermetic seal between each cover and fitting housing.

$50 Extra for Best Item

You are invited to submit Practical Ideas. You will be paid at regular rates when your item is printed and if it is judged the best for the month, you will get an additional payment of $50.

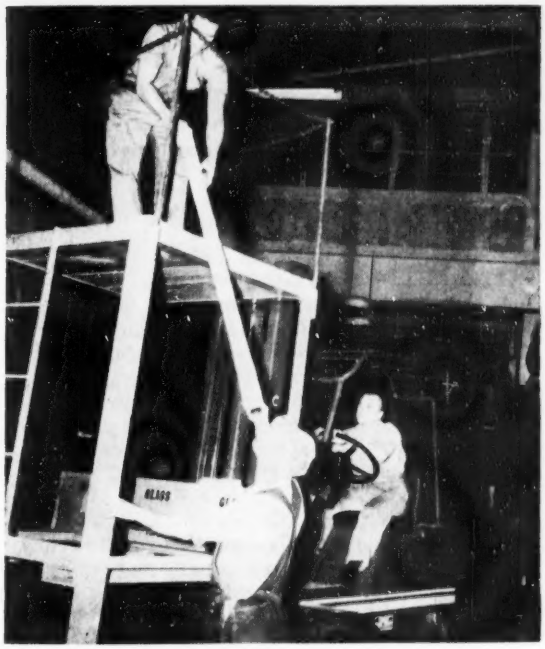
Selection of the best contributed item will be made by a group of 200 readers each month, and the item title and author's name will be cited (see below).

Practical Ideas may describe any type of device or method recently developed to solve a problem, speed an operation, or make some task easier. They may concern factory, laboratory, warehouse, or power-plant operations in the food industry. Ideas on management, maintenance, and trucking or shipping also are suitable.

You need not be an experienced writer or draftsman to submit these ideas. The text will be edited and sketches converted to finished drawings.

Send your items to: Practical Ideas Editor, FOOD ENGINEERING, 330 W. 42nd St., New York 36, N. Y.

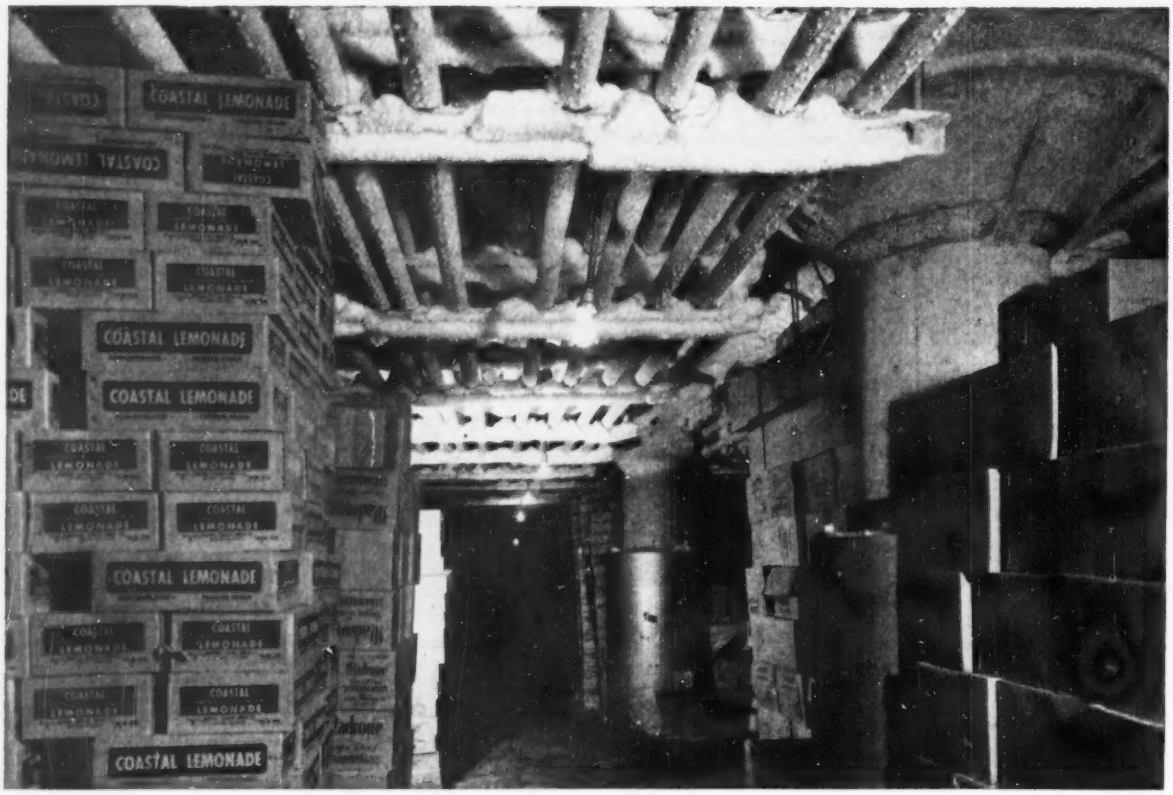
AUGUST PRACTICAL IDEA winner was "Home-made Steam Cleaner", which was submitted by Wm. C. Stretton, Van Camp Sea Food Co., Inc., Terminal Island, Calif. Described was a portable assembly constructed at a cost of approximately $35. It delivers to a nozzle either a steam-free cleaning solution or a steam-solution mixture.



Safeguard Lift-Truck Ceiling Jobs

Fork-lift-trucks can be profitably applied as a speedy means of reaching ceiling height for replacement of lights or other maintenance and repair tasks. However, when so used, safety precautions should be taken.

Strongly constructed platform, elevated 8-10 ft. on angle iron frames (see photo) will greatly extend height range accessible to workers when forks are lifted. Such an extension should not be considered unless adequate means of securing frame to truck forks is provided. Detachable safety rail around platform is also advisable.—*F. E. Staff.*



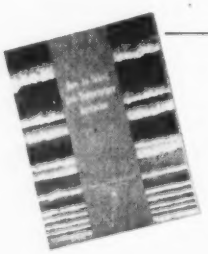
How long has corkboard helped hold this freezer room at —10°?

13 Years ☐ 18 Years ☐ 23 Years ☐

Here is a freezer room insulated with Armstrong's Corkboard that has been in operation for 23 years. It is located on one of seven freezer and cooler floors in the Wisconsin Cold Storage Company, Milwaukee, Wis. When the warehouse was built in 1930, the building was insulated with Armstrong's Corkboard. In the 23 years since then, the insulation has required no major replacement or repair. Walls, ceilings, and floors are dry and free of frost. There is no bulging or buckling. The corkboard is still holding temperatures of 5 to 10 degrees below zero at low refrigerating costs. It promises many more years of trouble-free, economical operation.

Exceptional service? Not for Armstrong's Corkboard. There are hundreds of corkboard installations throughout the country that have been giving the same satisfactory, low-cost service for twenty, thirty, and even forty years. This record cannot be matched by any other low-temperature insulation.

Whenever you need low-temperature insulation, call in Armstrong first. Our complete contracting organization can handle all phases of the job for you —from correct specifications to proper application. You get quality materials, skilled workmanship, and a dependable job installed with careful attention to all details. And you know that a responsible company stands behind the work. For further information call your near-by Armstrong office or write direct to Armstrong Cork Company, 2110 Seventh St., Lancaster, Pennsylvania.



Helpful Free Booklet!

Send for free booklet, "How to Select Low-Temperature Insulation." It tells you what to look for in low-temperature insulation, fully describes the features and properties of Armstrong's Corkboard, shows many installations.

ARMSTRONG'S INDUSTRIAL INSULATIONS

For temperatures from 300° below zero to 2800° F.

The Reader AUDITED PAID ABC CIRCULATION *His Mark*

THE ABC that appears in the symbol at the top of this page stands for Audit Bureau of Circulations. The symbol itself is an emblem of cooperation, in which every subscriber to this magazine has an interest.

The Audit Bureau of Circulations is a voluntary, non-profit, cooperative association. It was founded in 1914 and now consists of 3450 advertisers, advertising agencies and publishers in the United States and Canada. This magazine is proud to be a member.

ABC originally was set up to help take the racket out of publishing, to eliminate the waste and guesswork then so prevalent in publishing and advertising, to establish order and confidence in place of the misunderstanding and misrepresentation that arose from unverified circulation claims and dubious circulation practices. Its mission was to protect the interests of both readers and advertisers.

THIS IT DID by first defining the term "paid circulation." Then it established standards and rules to govern subscription sales practices and records. Finally it set up an auditing organization to verify the claims and report the facts concerning the circulation of each member publication. It now maintains on that job a working staff of sixty-five full-time auditors. So the ABC symbol has become the hallmark of circulation standards and advertising values. Each member publication must maintain those standards if it wishes to retain its membership and display the ABC symbol.

This ABC audit is no perfunctory affair. When a business publication, such as this one, becomes a member of the Bureau, it agrees that the auditors shall have "the right of access to all books and records." Their inspection, therefore, may cover any part of its operations. Original subscription orders, payments from subscribers, paper purchases, postal receipts, arrears of payments, and many more items are painstakingly checked by the auditors. In many instances they go behind the records to seek verification from subscribers themselves as to the terms of their subscriptions.

IN DOING ITS JOB, ABC has created many values for both publishers and readers as well as for advertisers. That is because the publication that becomes a member of ABC thereby offers the strongest possible guarantee of its primary devotion to the interests of its readers. The function of a business magazine is to be useful to its readers. When this service is rendered by an ABC publication, it is constantly subject to the practical test of reader acceptance and approval. As each subscriber has the right to purchase or refrain from purchasing an ABC publication, that collective right confers upon the readers the power to say whether or not the publication will survive. Thus the report on its ABC audit provides the most direct assurance that a publication stays in business only because of a voluntary demand by readers who find its editorial service responsive to their needs.

Naturally, the editor of each business publication follows closely the score thus racked up by his paper in its ABC reports. In the scope and tone of his editorial coverage and treatment, in the selection and presentation of his editorial content, he must constantly labor to maintain and enhance the readers' acceptance of his efforts. That is why the editorial standards established by ABC publications set the editorial standards for all publishing. That is how the ABC constantly stimulates its member publications to become even more useful to their readers.

AND THAT IS WHY the ABC symbol has become the Mark of the Reader, a constant reminder that his willingness to pay for an ABC publication is the acid test of its value both to him and to its advertisers.

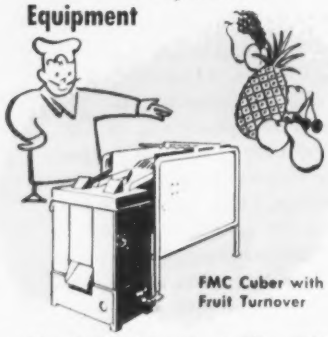
McGraw-Hill Publishing Company

PAST PRESENT and FUTURE

Dedicated TO SERVING through better equipment

HERE'S YOUR KEY TO MODERN CANNING

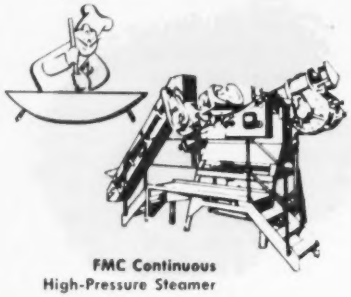
FMC Fruit Preparation Equipment



FMC Cuber with Fruit Turnover

Also: Pacific Rotary Peach Pitter, FMC Pear Preparation Machine, Tri-Roller Sizer, Draper-Type Peeling Scalder, Dunkley Peach Peeler and Washer. Freestone Peach Peeling Line, Peach Slicer, Shaker Sizer.

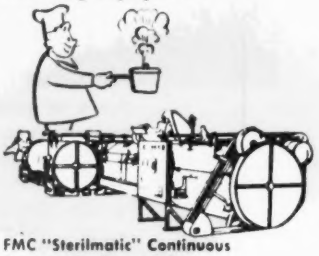
FMC Vegetable Preparation Equipment



FMC Continuous High-Pressure Steamer

Also: Continuous Vegetable Peeler, Steam Chemical Peeler, Rotary Washers, Flood-Type Washers, Shaker-Type Washer, Spinach Blancher, Hot Water and Steam Blanchers.

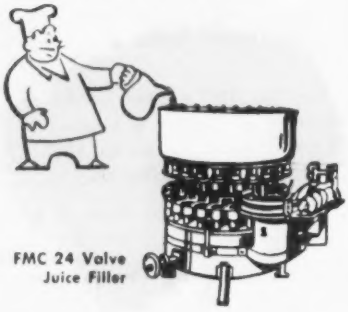
FMC Cooking, Cooling and Freezing Equipment



FMC "Sterilmatic" Continuous Pressure Cooker and Cooler

Also: Atmospheric Continuous Cookers and Coolers, Vertical and Horizontal Retort Kettles, Retort Crates, Continuous Juice Processor, Draper and Screw Type Fruit Preheaters, Continuous Round Shell Can Freezer.

FMC Filling Equipment



FMC 24 Valve Juice Filler

Also: Filling equipment in a complete range of sizes and capacities for filling liquids, semi-solids and granular products; Gravity and Vacuum Syrupers; Briners and Carton Fillers.

FMC Can Handling Equipment

FMC Non-Shock Caser

Also: "Stackmatic" Pallet Unloader, Air-Blast Can Dryer, Universal Can Washer, Can Unscrambler, Kyler Boxer and Labeler, Underweight Can Detector.

FMC Grading, Sizing and Conveying Equipment

FMC Shaker Sizers for Fruits and Vegetables

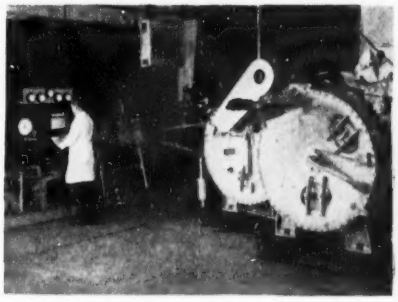
Also: String Bean Sizers, Cherry Cluster Separator, Tri-Roller Sizer, T-Belt Sizer, Roller Inspection Table, Peach and Pear Canning Table, Divided Belt Trimming Table, Tomato Trimming Table.

THE FOOD INDUSTRIES

for better food products

The needs of food canners and processors are foremost in planning new and improved equipment.

Constant analyses and research mark development stages to assure perfection of the finished products.



Careful, thorough testing with special laboratory instruments measures efficiency and performance.

What *fmc* engineering and scientific research mean to food canners

For more than three-quarters of a century, food canners and processors have looked to FMC for the creative developments in new and improved methods and equipment. During this time FMC has introduced scores of products designed to fill the specific needs of the industry—products that have figured prominently in setting new standards of efficiency and economy—new concepts of progressive operating techniques.

Behind the scenes at FMC is the constant search for even better equipment and ways of doing things. Here, research and engineering devotes its attention to studies of customers' requirements, and to application and performance of the product. New materials and technical developments are applied to product design and engineering within the practical limitations of manufacturing and cost.

When a new product emerges from the experimental stage, highly trained FMC technologists subject it to exhaustive operating tests under actual working conditions.

Today and in the years to come, you can continue to rely on FMC —*first in the field with better equipment for better food products.*

fmc Specialized Product Equipment Lines

In addition to producing literally hundreds of individual products for the preparation, canning and processing of fruits and vegetables, FMC is recognized as the leading manufacturer of complete lines of highly specialized equipment. Most outstanding of these lines are . . .

FOR CORN

Complete FMC "Stalk to Storage" equipment includes: Corn Harvester, Ear Corn Brusher, Double Husker, Corn Washer, Universal Corn Cutter, Mixers, Washers, Corn Trimmers.

FOR PEAS

Pea packers rely on FMC "Prize Pack" equipment such as: Twin and Single-Reel Sizers, Graders and Washers, Blanchers, FMC Pea Harvester, 8 Station Pea and Bean Filler, Tenderometer.

FOR TOMATOES

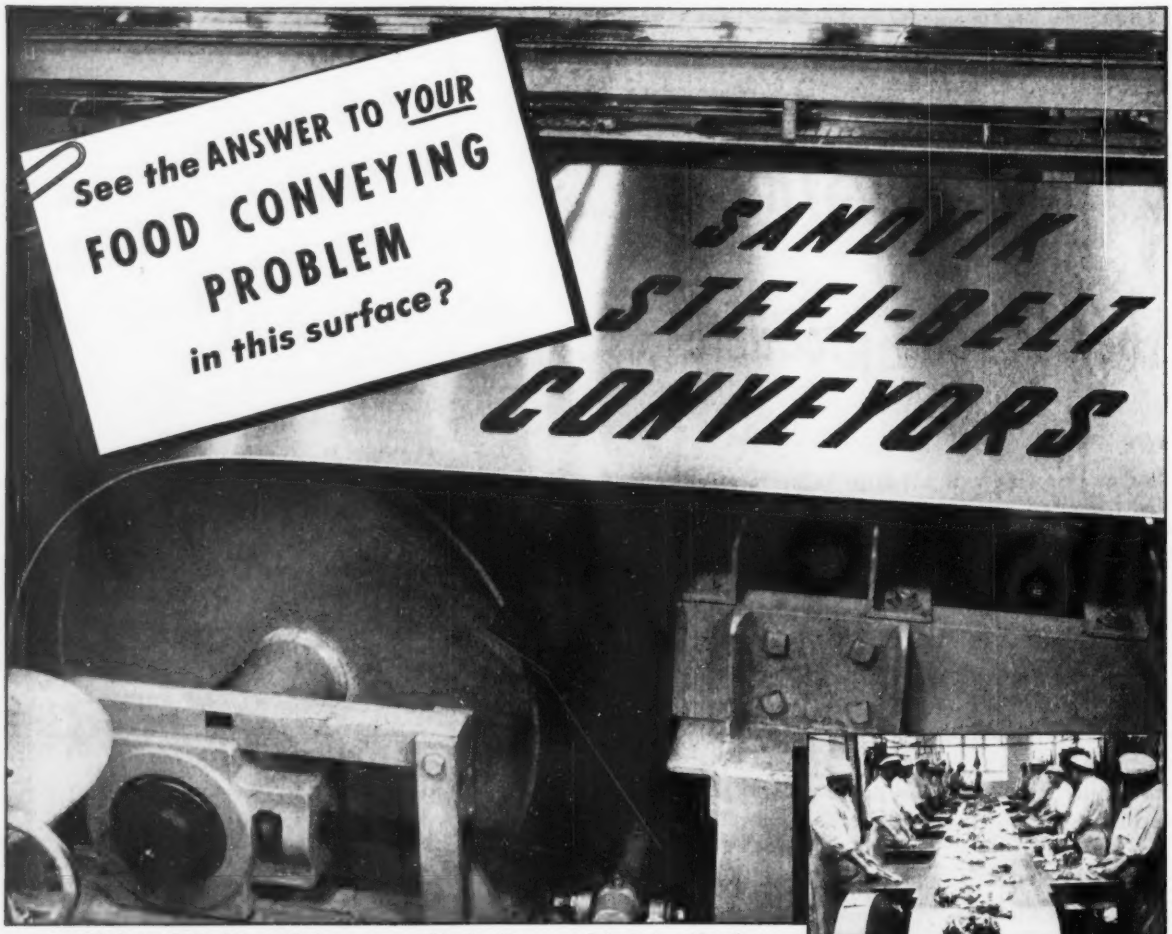
Cost-saving FMC Tomato Preparation and Processing Equipment includes: Low and High Pressure Tomato Lines, Scalders, Pulpers, Finishers, Extractors, Choppers, Fillers of all types.

FOOD MACHINERY AND CHEMICAL CORPORATION

Canning Machinery Division

General Sales Offices:

WESTERN: SAN JOSE, CALIFORNIA **EASTERN:** HOOPESTON, ILLINOIS



An eight-foot wide Sandvik steel-belt conveyor used for handling cans of shortening. The plant where this conveyor is installed has experienced up to 25 years of satisfactory service from an earlier Sandvik conveyor installation.

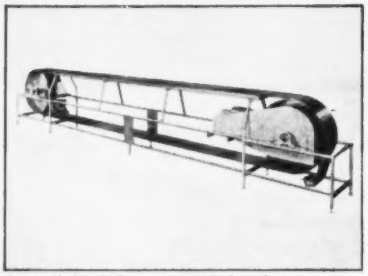
Sandvik steel-belt conveying work table makes cutting up of dressed hogs a continuous production line operation.

The smooth, impervious, easy-to-clean surface of Sandvik steel-belt conveyors has improved processing of a wide variety of foods. Here are some reasons why:

The conveying band provides a continuous, unbroken flat surface of stainless or carbon steel. — Live steam or boiling water can be applied directly. — Steel scrapers can be used for cleaning or discharge. — Withstands baking or drying temperatures. — No taste contamination. Smoothness facilitates slide handling (a vital advantage for can conveying). — High load capacity. — Long service life. — Belts can be of any length or width.

COOLING ARRANGEMENT—Sandvik conveyors can be built with a patented water-bed arrangement which cools from beneath . . . no water gets on top of the band. You can cool and convey, regulate thickness while cooling, cool and strip off gelatinous materials in sheet form, cool loose and pulverized materials, cool solids in sheet form and cool materials in layers.

ENGINEERING HELP—Sandvik's engineering department will be glad to work with you in designing a conveyor to fit your operation. Sandvik has had over thirty years of experience in designing conveyors to operate either as independent units or as integral parts of special processing equipment.



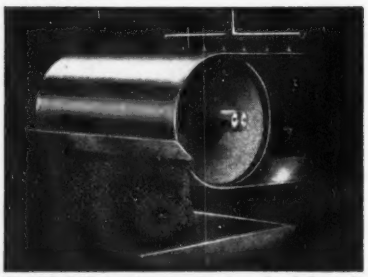
A small Sandvik conveyor designed to cut meat handling costs.

Write, wire or phone for further information.

SANDVIK STEEL BELT CONVEYORS

SS-85

SANDVIK STEEL, INC., *Conveyor Division*
111 Eighth Avenue, New York 11, N. Y., WAtkins 9-7180
Chicago • Cleveland • Los Angeles
Manufacturers of Steel Belt Conveyors for Over Thirty Years.



Simplified illustration showing how Sandvik steel-belt was used in a continuous vacuum drier for soluble coffee. Scraper blade removes crystallized coffee from band.

DOW

DOW PROPYLENE GLYCOL, U.S.P. FOR FINER FOOD FLAVORS

This high purity solvent is more economical for an extremely wide range of flavoring raw materials

Dow propylene glycol, U.S.P., has gained wide acceptance among manufacturers of fine food flavors for its highly efficient solvent action on a wide and varied range of flavoring raw materials.

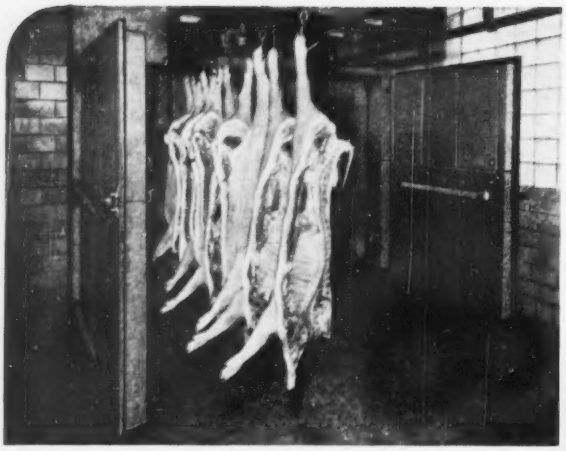
Many manufacturers of food colors for both bulk and household use have improved their products with propylene glycol . . . with only slight alterations in basic formulations. Emulsified flavors, too, benefit from the wetting action of propylene glycol, which increases the stability of the emulsions.

To aid you in evaluating Dow propylene glycol, U.S.P., as a replacement for other more expensive and less effective solvents, we will be glad to send you a free sample and further information. Send your request to THE DOW CHEMICAL COMPANY, Midland, Michigan. *Dept. OC-3-28 A.*

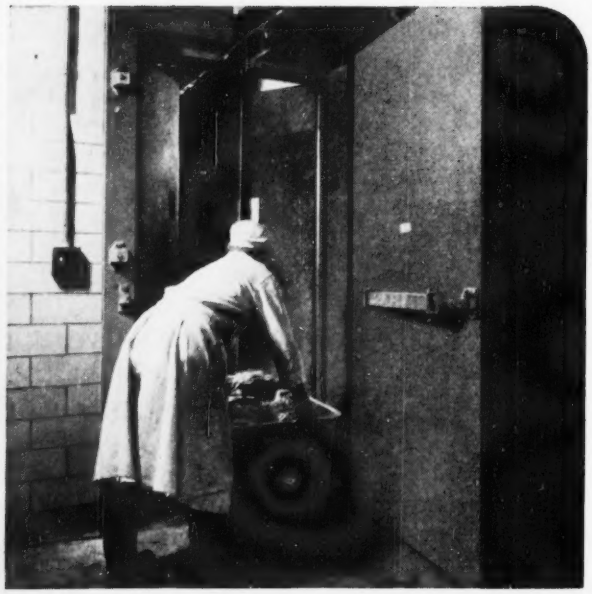
you can depend on DOW CHEMICALS

DOW

For more information, use coupon on page 207.



PATENTED HARDWARE—hinges, fasteners, bump open bars and door closers are designed and built by Jamison to meet the severe requirements of cold storage service.



THREE-POINT FASTENING INSURES POSITIVE SEALING. The pressure on the fastener side of this Series "50" Vestibule Track Door is kept equal to the hinge side by 3-point fastening. This assures a positive seal.

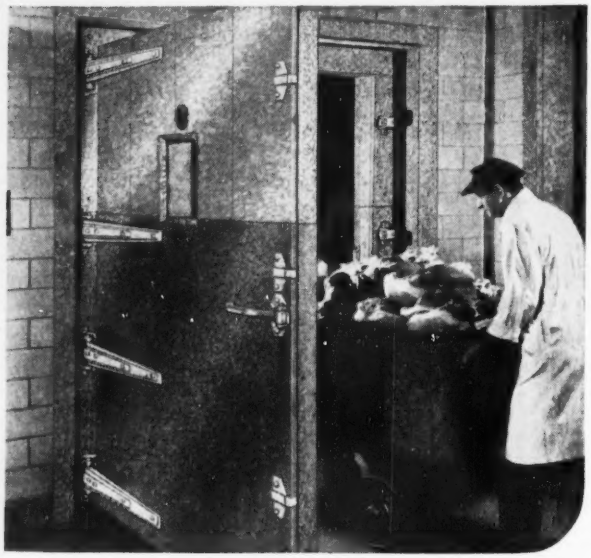
why

JAMISON DOORS

are specified for

PACKING HOUSES

MAXIMUM STRENGTH AND RIGIDITY. These Series "50" Double Doors have extra strength and rigidity due to mono-panel construction with a box frame and one piece "Boat Hull" plywood panels front and back.



METAL CLADDING SIMPLIFIES CLEANING—where maximum sanitation calls for frequent washing down of floors and walls, complete metal cladding makes this possible for the door also.

Architects and contractors specify Jamison Doors because of their proven dependability and exclusive features that assure long trouble-free service.

JAMISON COLD STORAGE DOOR CO., HAGERSTOWN, MD.

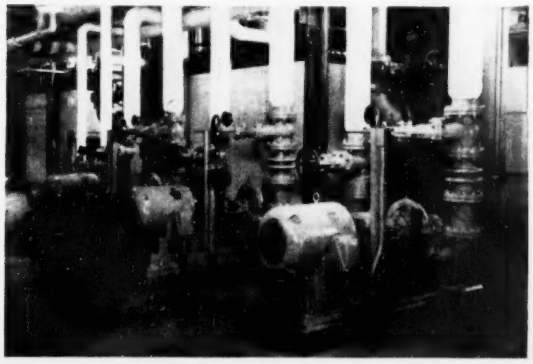
JAMISON

HAGERSTOWN, MARYLAND, U. S. A.

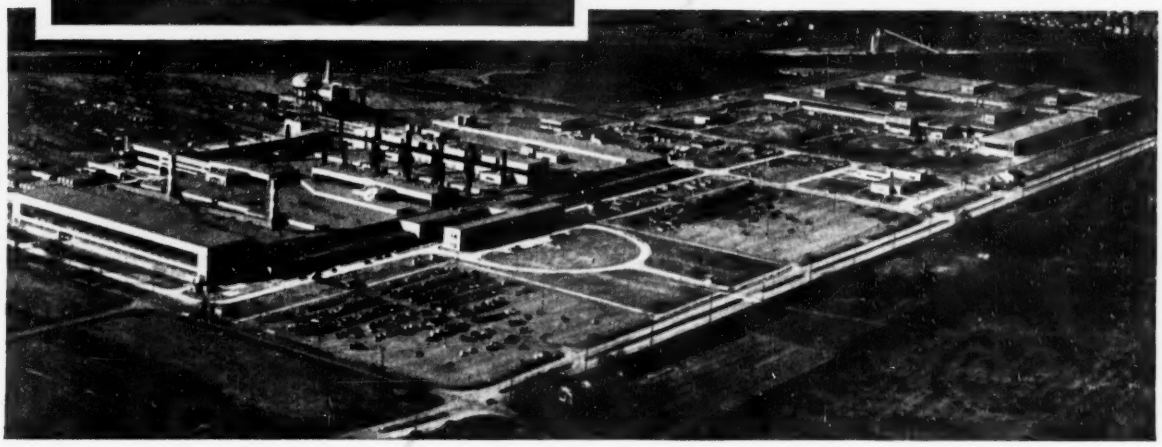
THE LEADER FOR OVER FIFTY YEARS

Oh, I see

OIC VALVES at work in the power plant at Ford Motor Company.



THE CLEVELAND PLANT of the Ford Motor Company, showing the engine plant, foundry and power plant.



...they're using our valves at FORD

Ford cars are an example of true manufacturing efficiency. Ford buys only that equipment which can be relied upon to maintain or increase such efficiency.

OIC's Long Line of valves meets Ford's exacting specifications. They're used here on basic facilities and main piping systems for water, steam and air. Because they're precisely engineered for long, trouble-free service, OIC Valves can help you achieve maximum efficiency in control of flow. Write for catalog information or engineering assistance in selecting and applying valves.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC FOUNDED 1882

VALVES | **FORGED & CAST STEEL, IRON & BRONZE, LUBRICATED PLUG VALVES**

WHAT YOU DO RIGHT NOW IS MIGHTY IMPORTANT

That moment when he hits . . . if you don't set the hook hard and firm, you'll never see him in the boat. And *this* moment in business . . . now's the time to give yourself the competitive edge you're going to need, perhaps sooner than you think. ● Allegheny Metal can reduce costs, add strength, increase service life, improve appearance, cut weight, overcome rust. How many of those properties of stainless steel can you use to advantage, and how can we help you to do so? ***Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pennsylvania.***

You can make it **BETTER** with

Allegheny Metal

TIME-TESTED STAINLESS STEEL

Warehouse stocks carried by all Ryerson plants

WBG 47188

For more information, use coupon on page 207.

GIRDLER
...all produced with
Votator®
CONTINUOUS PROCESSING APPARATUS
FARMDALE COLORED OLEOMARGARINE
DALEWOOD COLORED MARGARINE
NU MELLO MARGARINE
FARM QUEEN OLEOMARGARINE
WILSON'S OLEOMARGARINE
BLUE PLATE MARGARINE
SWANSON MARGARINE
MEADOWLAKE MARGARINE
NUCOA MARGARINE
Country Fresh OLEOMARGARINE
ARMOUR MAYFLOWER OLEOMARGARINE
Allsweet OLEOMARGARINE
SWANSON Creamo OLEOMARGARINE
GOOD LUCK OLEOMARGARINE
Blue Bonnet
KRAFT PARKAY MARGARINE
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CHURNGOLD MARGARINE
RICHMADE OLEOMARGARINE
DELRICH OLEOMARGARINE
MAR-GOLD MARGARINE
BLUE JEAN OLEOMARGARINE
HERE'S WHY

Perfect quality control... high efficiency apparatus first choice of

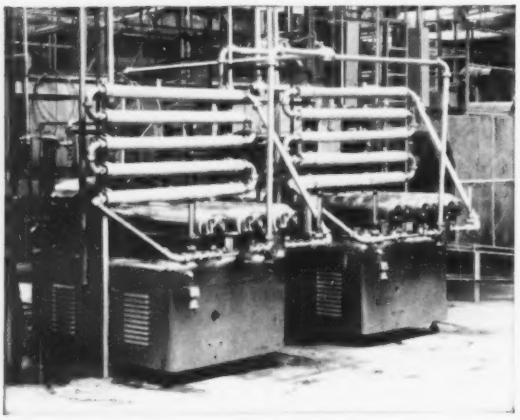
ONE OF THE most outstanding testimonials to any manufacturing equipment is provided by producers in the margarine industry. Here, VOTATOR* Continuous Processing Apparatus is used *exclusively* for the production of over 90% of the margarine made annually in the U.S.!

This equipment has won this acceptance because of these outstanding advantages:

- Precise mechanical control of the operation permits exact control of quality at all times, assuring uniformity.
- The closed system prevents any contamination or waste. Purity, freshness and flavor are safeguarded at all times.
- With continuous, automatic operation labor costs are held to a minimum.
- Large volumes can be processed in a small floor space.

VOTATOR Processing Apparatus provides these benefits not only for margarine and other edible oil products but for many products throughout the food industry. A wide variety of liquid or viscous materials can be mixed, aerated, heated or cooled with this equipment. Mixing is thorough and intimate, and processing can be completed in a matter of seconds.

*VOTATOR Trade Mark Reg. U. S. Pat. Off.



STERILIZATION

VOTATOR Heat-transfer Apparatus is used successfully for such operations as sterilization. Here it heats the product to temperatures of 280°F or 290°F, holds at the elevated temperature, and cools to a pre-determined level, all under precise mechanical control. The accuracy and speed of reaching sterilizing temperatures avoids damage to the product. Extremely viscous or heat-sensitive materials, which cannot be sterilized by any other method, are processed efficiently with this method.

WHAT'S YOUR PRODUCT?

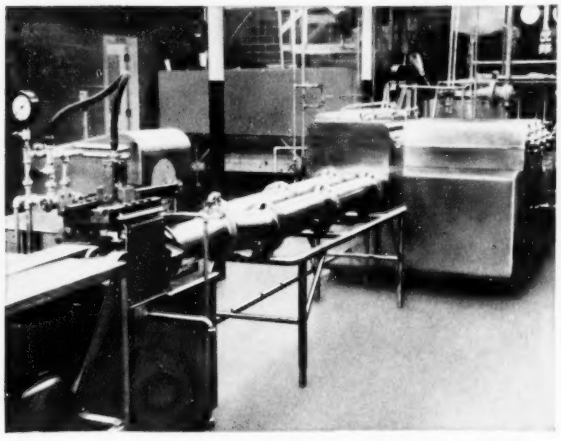
These Processing Operations can be improved with Votator Continuous Processing Apparatus

FUNCTION	PRODUCT
Cooling, Whipping, Aerating	Marshmallows
Mixing	Cake Batter
Sterilizing and Cooling	Cream Style Corn
Cooking, Sterilizing and Cooling	Dog Food
Sterilizing and Cooling	Chocolate Milk Drink
Cooking and Cooling	Edible Starch (For Salad Dressing)
Cooking, Pasteurizing and Cooling	Pie Filling
Sterilizing and Cooling	Strained Food
Sterilizing and Cooling	Soup
Chilling and Plasticizing	Lard
Continuous Manufacture	Margarine
Chilling and Plasticizing	Shortening
Cooling and Crystallizing of Sugars	Sweetened Condensed Milk
Cooling and Crystallizing of Sugars	Invert Syrup
Pasteurizing and/or Chilling	Eggs
Slush Freezing	Concentrates, Fruit Juices and Purees
Enzyme Inactivation, Sterilization, Cooling	Juice Concentrates
Cooking and Cooling	Starch Gum Jellies

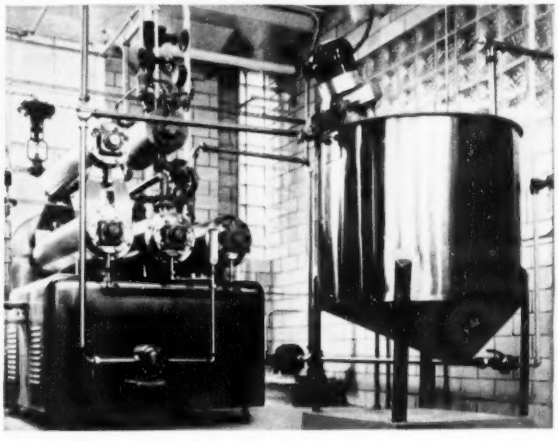
the GIRDLER Company

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

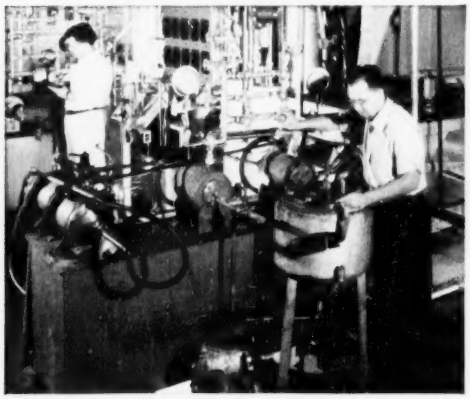
make Votator® continuous processing the edible oils industry



This margarine manufacturer purchased a completely integrated processing plant from Girdler. Girdler's Votator Division has designed, engineered, and built an impressive number of *complete* plants which convert refined, bleached, hydrogenated, and deodorized oils to packaged products.



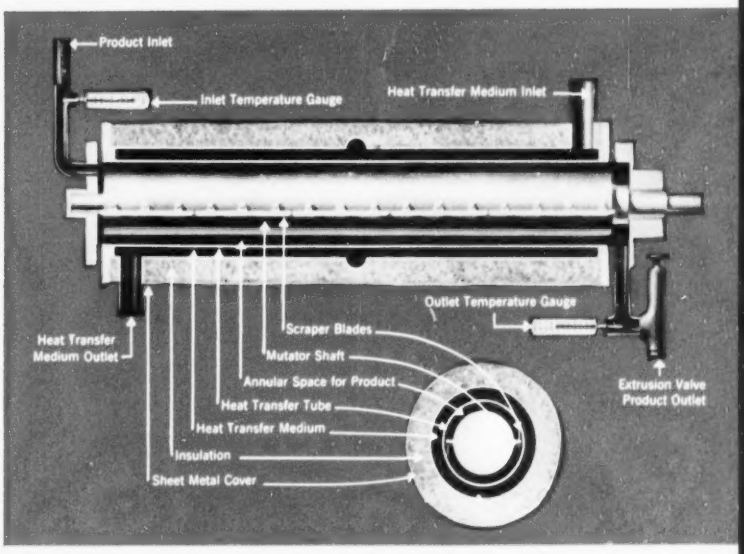
This installation of VOTATOR Processing Apparatus performs the two functions of cooking and cooling in the production of starch for salad dressing.



HELP FOR YOUR PROCESSING PROBLEMS

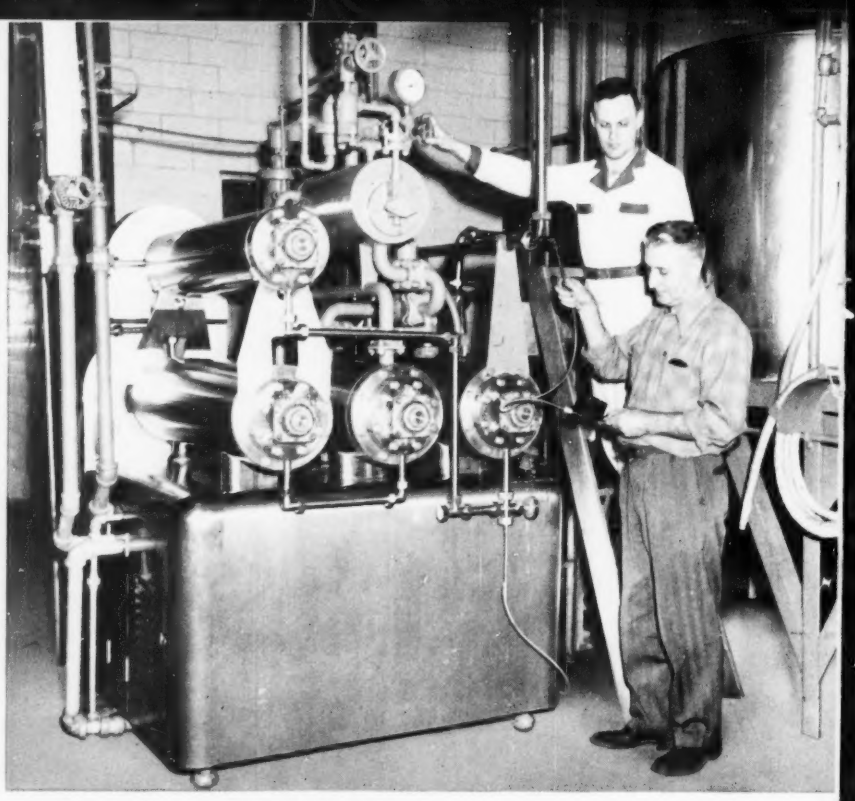
Girdler chemists and engineers in the fields of oil processing and food technology have developed distinctive processes and apparatus for many applications. The process engineering group includes specialists to help on many diversified problems. Girdler's pilot plant and laboratory facilities are utilized constantly for research on new applications, and development. A technical staff is available for consultation, and a research group can be employed to work on special projects at reasonable cost.

HEART OF THE CONTINUOUS PROCESSING SYSTEM



VOTATOR DIVISION • LOUISVILLE 1, KENTUCKY... New York • Atlanta • Chicago • San Francisco

Girdler offers complete process-engineering and construction service



Complete salad dressing processing plant at Durkee Famous Foods Division of The Glidden Company

YOU CAN SAVE valuable engineering man-hours, and assure proper coordination of your process projects by taking advantage of Girdler's extensive experience. Girdler's complete service covers process engineering and design, manufacture of necessary equipment, and plant construction.

For evaluation of new processes, Girdler offers cost-plus contracts covering preliminary engineering. This includes process recommendations, process flow diagrams, general equipment specifications, plot plans, cost estimates, and operating cost data. Such accurate and detailed data, prepared by a single responsible source, greatly simplify planning, and insure sound decisions.

GET THE FULL STORY TODAY!

This 32-page book gives you complete information on the application of Votator Heat-transfer Apparatus. It contains a 12-page technical section with valuable reference data and charts. Write for your free copy today.

THE GIRDLER COMPANY
224 East Broadway, Louisville 1, Kentucky

Please send booklet describing Continuous Processing.

Name

Position

Company

Address

City *State*

The
GIRDLER
Company

A DIVISION OF NATIONAL CYLINDER GAS COMPANY
LOUISVILLE 1, KENTUCKY
Votator Division: New York, Atlanta, Chicago, San Francisco

Their Secret of Smart Packaging Is

BAKELITE TRADE-MARK Polyethylene

The muscle-builder for the waxes coating these wrappers is BAKELITE Polyethylene Resin, mixed in before the wax is applied to the paper.

The result is a package with more sales appeal . . . fresher . . . more durable. Paper strength is increased, gloss is greater, wax rub-off is reduced, heat-sealed bonds are stronger. Colors and printing stay bright and clear—the inert, colorless BAKELITE Polyethylene adds gloss, improves texture. Foods are safe—BAKELITE Polyethylene is essentially odorless, tasteless, resistant to cracking at low temperatures.

Used in any of its various forms, BAKELITE Polyethylene brings these extra features to packages. It can be extruded or laminated to paper or foil to fill pinholes, add toughness, give a strong, quick heat-seal. It can be molded into flexible colored bottles, carboys, closures, and dispensing devices. As film, fabricated into bags, it keeps contents fresh by permitting the passage of gases and preventing the passage of moisture.

Such a variety of properties and applications are at your service when you look at BAKELITE Polyethylene as a packaging material. To learn more about how it can be used, write Dept. RV-74.

Wrappers and Labels Courtesy of
Pollock Paper Corp.
Dallas, Texas

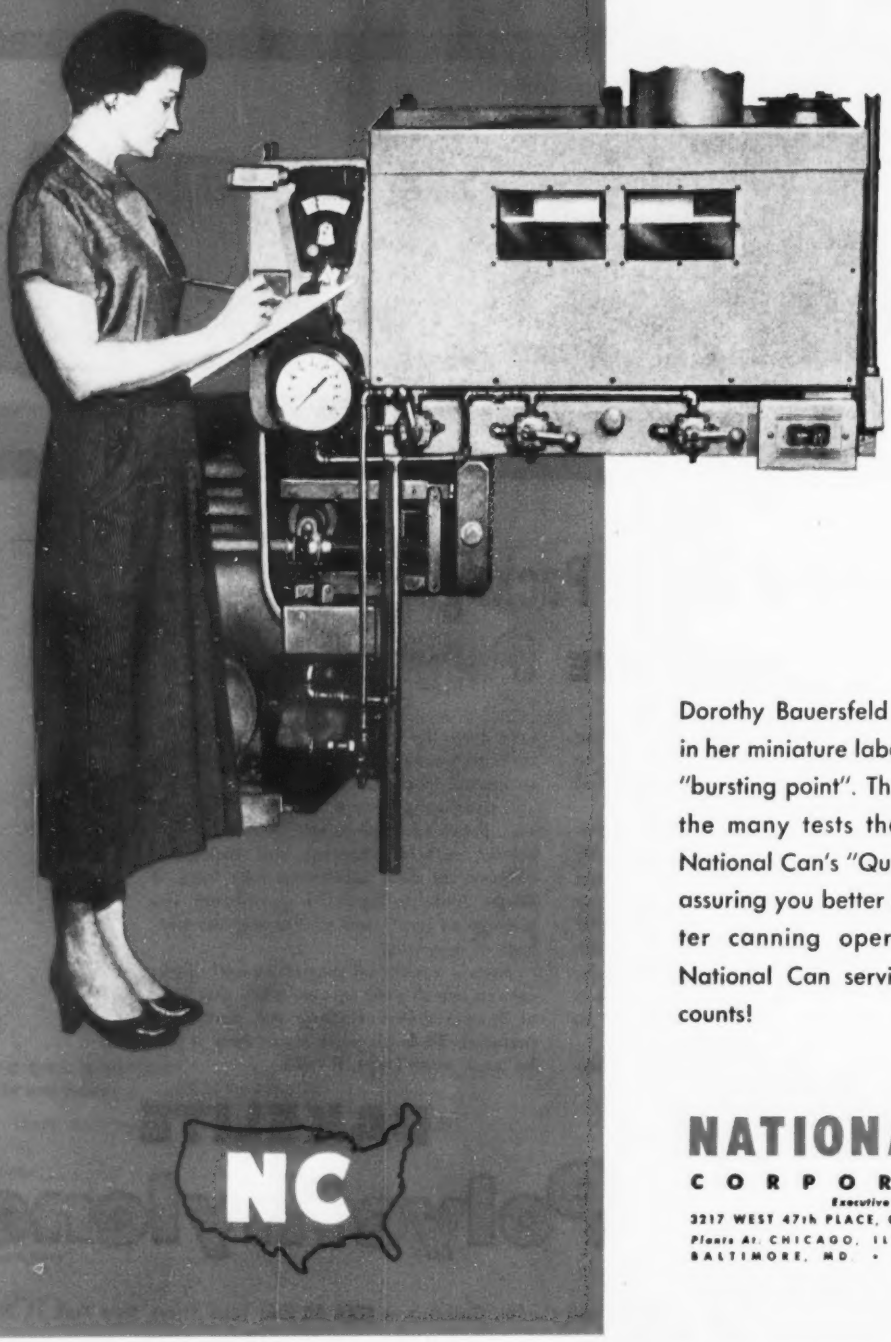
BAKELITE TRADE-MARK
Polyethylene

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N.Y.

For more information, use coupon on page 207.

at

NATIONAL CAN



she works for you

Dorothy Bauersfeld tests beer cans in her miniature laboratory for their "bursting point". This is only one of the many tests that are part of National Can's "Quality Control"... assuring you better cans and a better canning operation. Typical National Can service . . . where it counts!

NATIONAL CAN
CORPORATION
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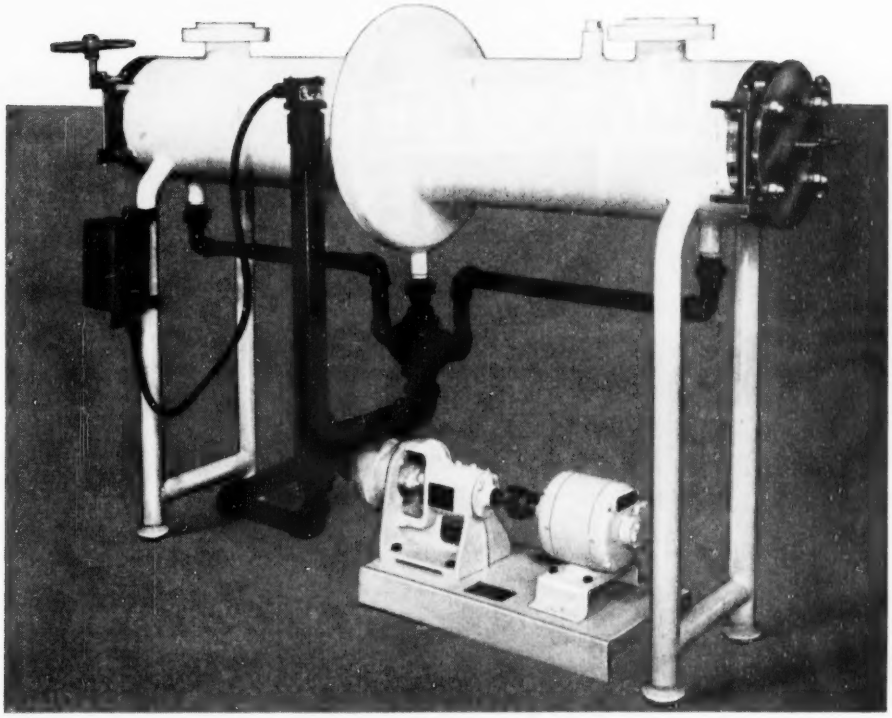

Faster HEATING and COOLING

can help you speed up production

If you are having trouble increasing your volume to meet peak seasonal demands, the heating and cooling steps are likely to be your major obstacles.

Continuous, high-speed heating and cooling can eliminate this bottleneck. By installing a Pfaudler shell and tube heat exchanger, you can heat or cool up to 33,600 pounds of product per hour.

LOW-COST OPERATION— Many well-known food companies are finding that Pfaudler stainless steel heat exchangers—built to sanitary code—enable them to increase their output considerably, without any increase in operating costs.

Maintenance is simple. Hinged stainless steel doors permit rapid in-place cleaning. And the high-speed efficiency eliminates the possibility of fermentation or spoilage. Pressures as high as 75 psi. are permitted by the sturdy welded construction.

To help you solve your heat exchange problems, Pfaudler has prepared a comprehensive 40-page heat exchanger manual. It has all the data you need to work out capacity and type problems. Easy-to-follow tables, curves and charts. Also full details on Pfaudler heat exchangers. Just mail the handy coupon for your copy.

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Gravity Fillers · Deaerators
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Please send me the Pfaudler Heat Exchanger Manual No. 837

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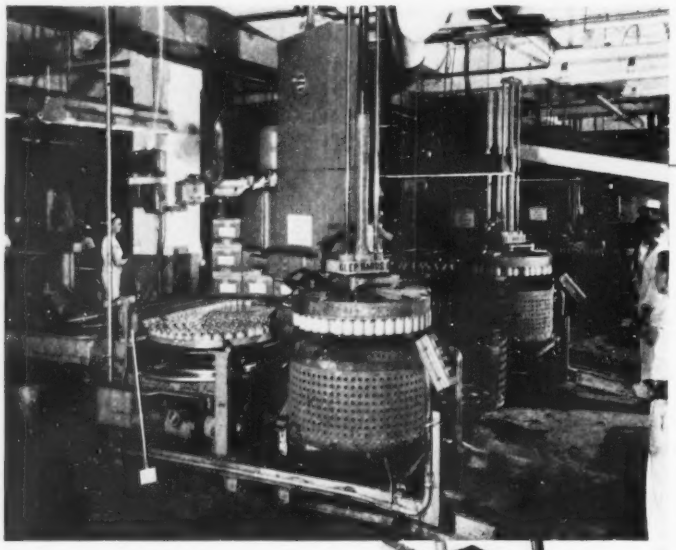
W. F. & JOHN BARNES

. . . offers this COMPLETE MODERN SERVICE to the Food Packer—

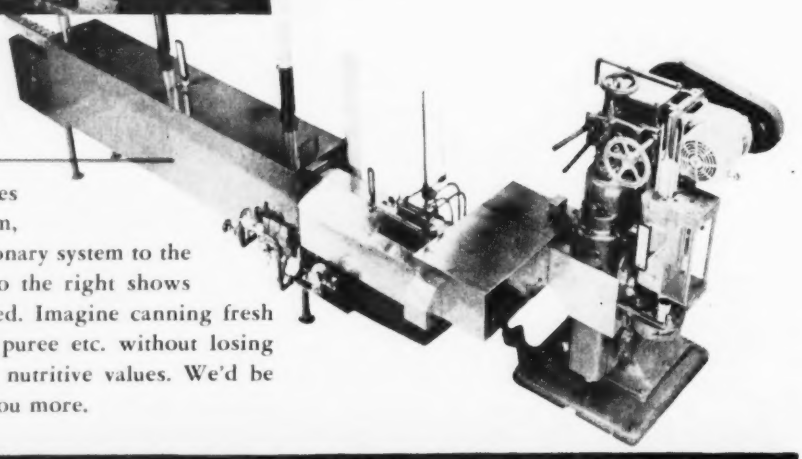


Loading 500 jars per minute with minimum breakage

Shown above is a Barnes retort basket loader. It handles over 500 baby food jars per minute. It is one of other Barnes machines and equipment which is helping manufacturers to lower costs through faster handling and minimizing breakage of glass jars. It is the result of close co-ordination between food packer and our engineers.

Martin Aseptic Canning System

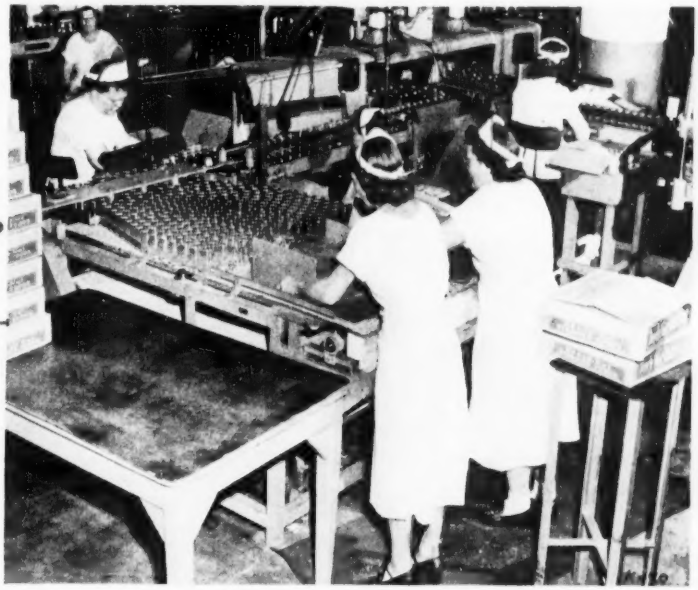
As sole manufacturing representatives of the Martin Aseptic canning system, we are pleased to offer this revolutionary system to the food packer. The unit illustrated to the right shows the compact basic equipment needed. Imagine canning fresh whole milk, orange juice, banana puree etc. without losing flavor, color or nutritive values. We'd be pleased to tell you more.



W. F. and JOHN BARNES

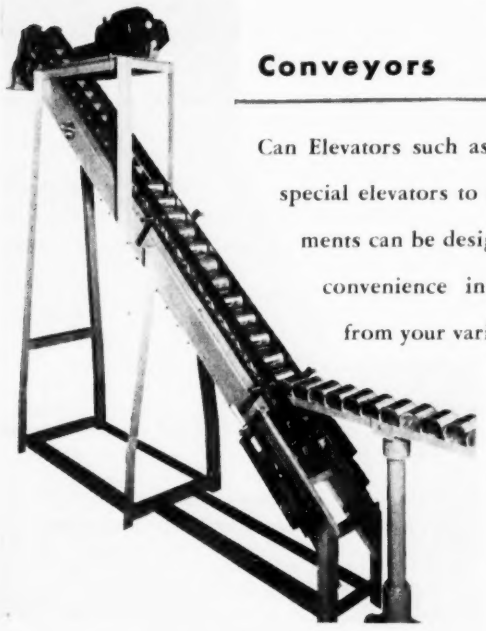
PROCESS EQUIPMENT DIVISION 303 SOUTH WATER STREET, ROCKFORD, ILLINOIS

Food packing is a fascinating business but, as you know, it also has its problems. That's where we'd like to come in. We are relatively new in this field but have had some success in helping packers solve knotty problems. So, if you pack in glass or tin we'd be most interested in working with you in *any* phase of production. Your inquiries will be given careful consideration and prompt attention.



Single Filers

Here's a new, efficient method of unscrambling empty glass. The illustration shows operating end of machine where girls are positioned while dumping cases of glass onto the receiving conveyor belt. Jars pass gently through agitating fingers and are discharged to conveyor at the rate of 500 to 600 per minute depending upon size and shape. Other models available for filled jars.



Conveyors

Can Elevators such as illustrated at the left or special elevators to suit your specific requirements can be designed to suit the maximum convenience in handling cans to and from your various processing machines. If you pack in glass or tin, call on Barnes engineers for suggestions. There is no obligation for this service.

Other Barnes Products

Actually our service to the food packer consists of engineering and manufacturing facilities. The products represent the end result of a close coordination between the packer and our process engineers. If you have any problem or wish to improve your processing methods and lower costs call a Barnes engineer. If you wish additional information write for bulletins F-1053.

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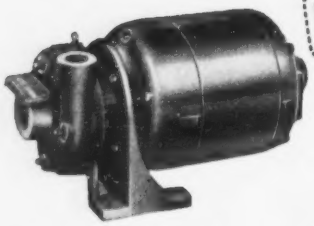
IMMEDIATE SHIPMENT

...OF I-R MOTORPUMPS

IMMEDIATE SHIPMENT



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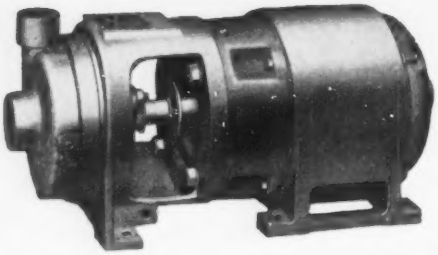

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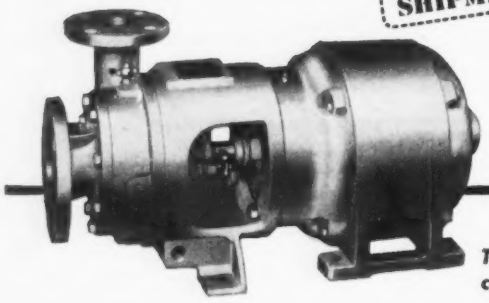

No delay in putting these advantages to work in your plant, *NOW*

LONG, TROUBLE-FREE LIFE: Designed and built by specialists in the field, Ingersoll-Rand Motorpumps have proved their ability to stand up under severe service. You can put these rugged pumps in and forget them!

EASY INSTALLATION: Operate equally well in any position. Easily bolted to floor, wall or other equipment. No special foundations needed!

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LOW FIRST COST: You can often use a more efficient, *lower hp* Ingersoll-Rand Motorpump to do the job. You save on first cost, weight, space and power consumption.

Available in sizes from ¼ to 50 hp. Capacities from 10 to 1800 g.p.m. Heads up to 650 ft.

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To keep vital production up these days, contact us for complete data or help on any of your pumping problems

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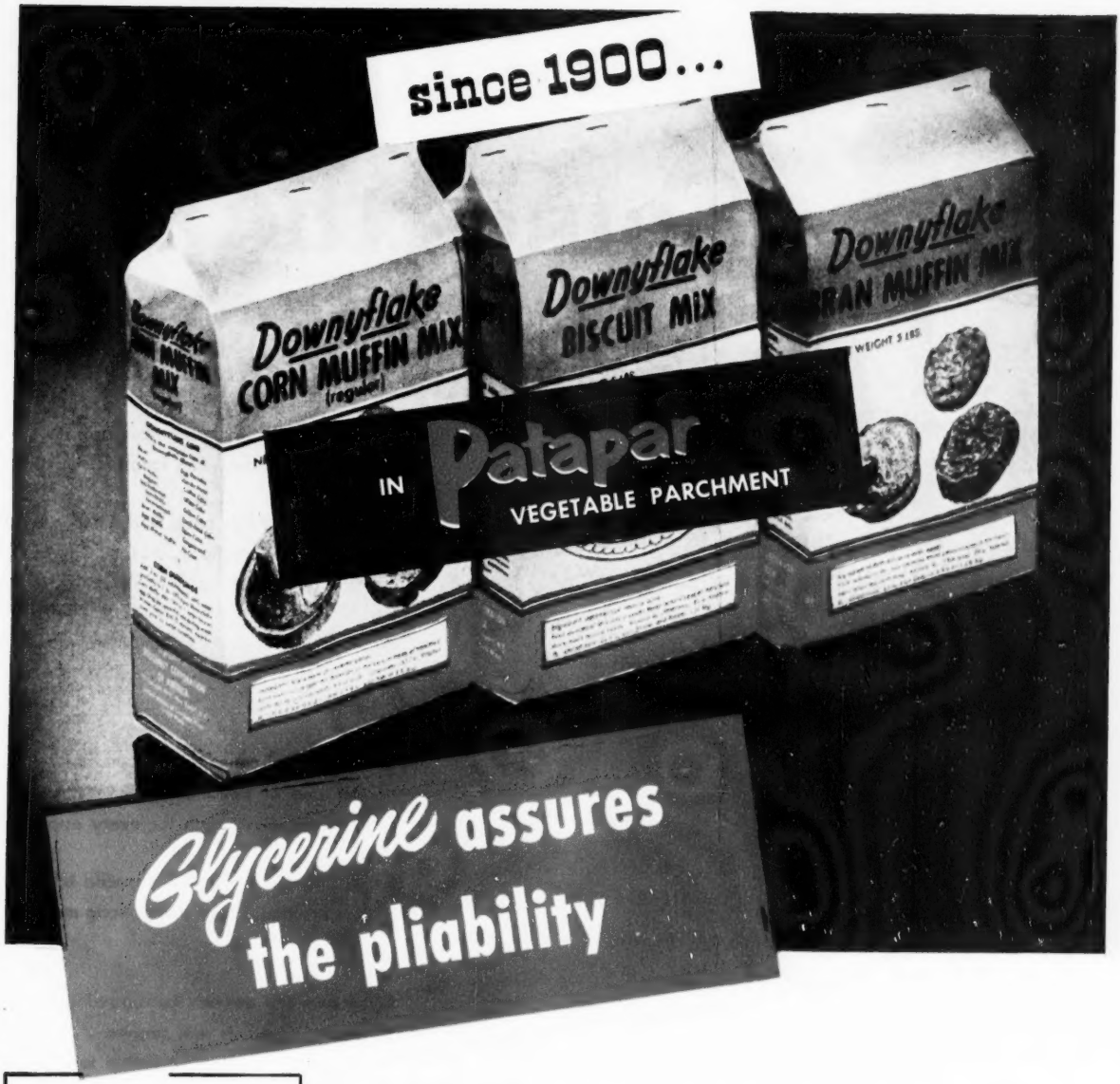

Since 1900, Paterson Parchment Paper Company has used Glycerine to plasticize its Patapar Vegetable Parchment for packaging foods such as butter, margarine, shortening, pie mixes, fish, meats, poultry, celery, ice cream and frozen foods. More recently, Doughnut Corporation of America's famous biscuit and muffin mixes are Patapar-wrapped. Patapar has high wet strength and grease resistance. It must also be pliable. For over fifty years, Paterson Parchment Paper Company has used Glycerine to assure this pliability.

The plasticizing and moisture-retaining action of Glycerine adds an important "plus" to vegetable parchment, and to other widely used packaging materials. It contributes the softness and pliability essential in wrapping and bag forming.

And, of course, a food packaging material must not contain any materials unsafe for use in contact with food. Here again, Glycerine is the ideal answer. It has a long-time record of acceptance, not only in food wraps, but in food products themselves. In fact, it has food value in its own right.

Applications of U. S. P. Glycerine in food processing—as a humectant, sweetener, solvent, plasticizer—have been accepted by the American Medical Association Council on Foods, and permitted by Federal and State food and drug authorities.

For a copy of "Why Glycerine for Foods?" a handy 16-page booklet on Glycerine's unique range of properties and applications, write Glycerine Producers' Association, 295 Madison Ave., New York 17, N. Y.

Nothing takes the place of Glycerine

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AND NOW-

Out of the Great Comes the *NEW*

With the advanced Diamond "Z" Grid, Gould makes another contribution to storage battery perfection! Here is the most recent achievement of the famous Gould Laboratory . . . one more example of Gould progress through *continuous* battery research.

New research developments make it possible to combine the design advantages of the original Diamond grid and the "Z" grid. The Diamond "Z" gives you the structural design of diamond bracing and overall mechanical strength, and still retains the uniform density of grid members so well achieved in the "Z" design.

This advance could only come from Gould . . . for only Gould has the experience with both the Diamond grid and the "Z" grid. The Diamond "Z" grid is another step forward in Gould's research program to give you extra battery performance, longer battery life. When you buy, buy Gould!

HERE'S WHAT YOU GET:

1. A grid built to the demands of users with top performance and long life.
2. A grid that has been tested under rugged operating conditions . . . tough day in and day out service.
3. A grid built to meet tomorrow's needs but available today . . . years ahead of requirements.
4. A grid that cannot "grow" under the toughest kind of treatment . . . with that extra measure of strength for every application.
5. A grid that is built with diamond bridge-like construction . . . with extra strong members to withstand abuse.
6. A grid that delivers the rugged service that future demands will require . . . demonstrated in every conceivable test for long, dependable operation.

Write for the new Catalog featuring this amazing grid that delivers more for your money.

TODAY THE GOULD DIAMOND BATTERIES

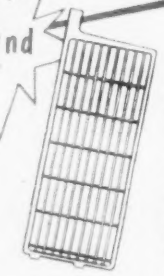
THE DIAMOND GRID

1st

This basic grid design was advanced for its day, highly efficient. For many years, it was the standard by which other batteries were judged.

THE "Z" GRID

2nd



Here was a tremendous advance in battery design. Intensive Gould research produced an improved casting method, which for the first time made possible larger, longer-life grid members.

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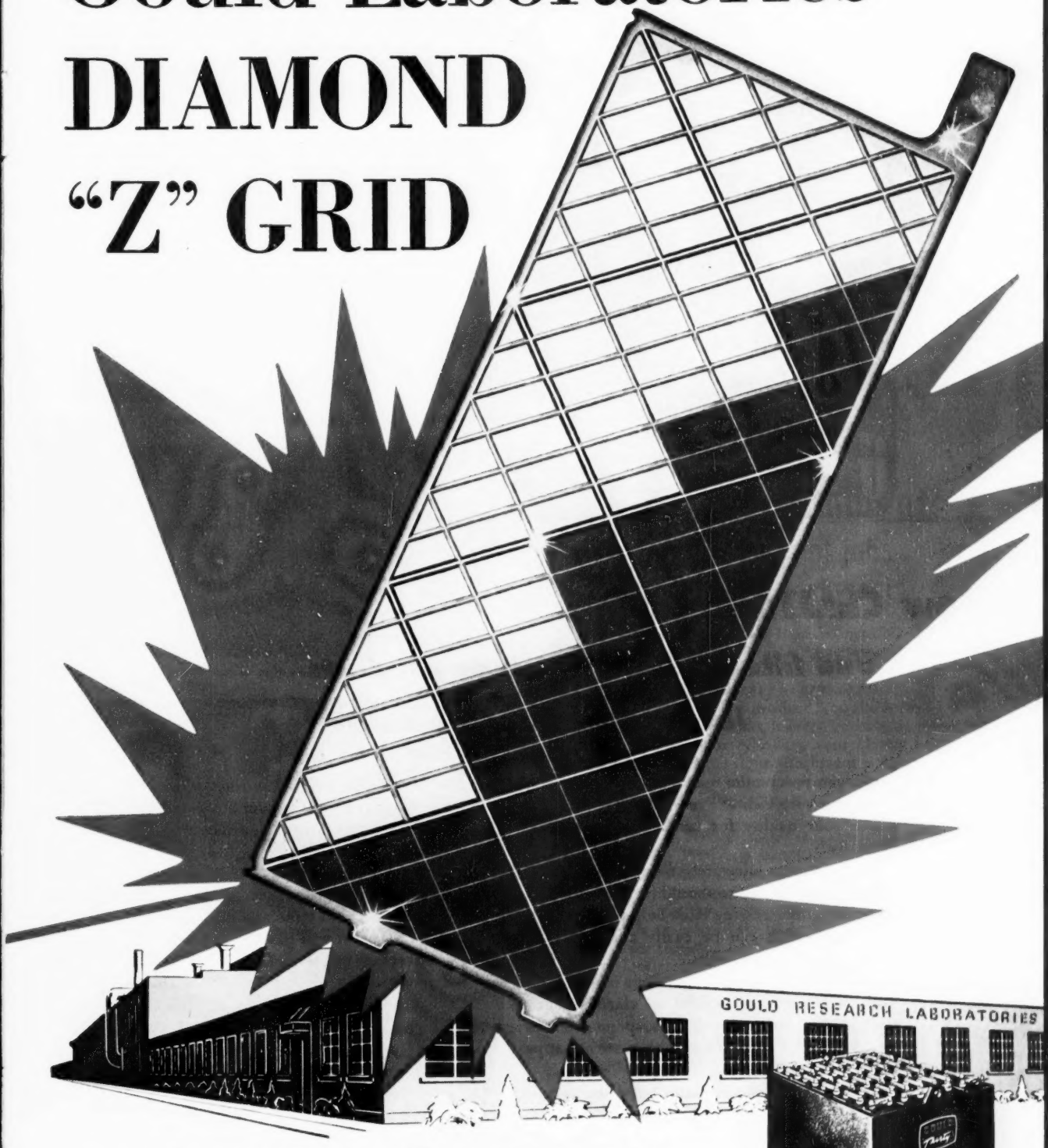
Visit us at the National Industrial Packaging and Materials Handling Exposition, Boston, October 20 to 22, Booth 317.

Gould Laboratories DIAMOND "Z" GRID



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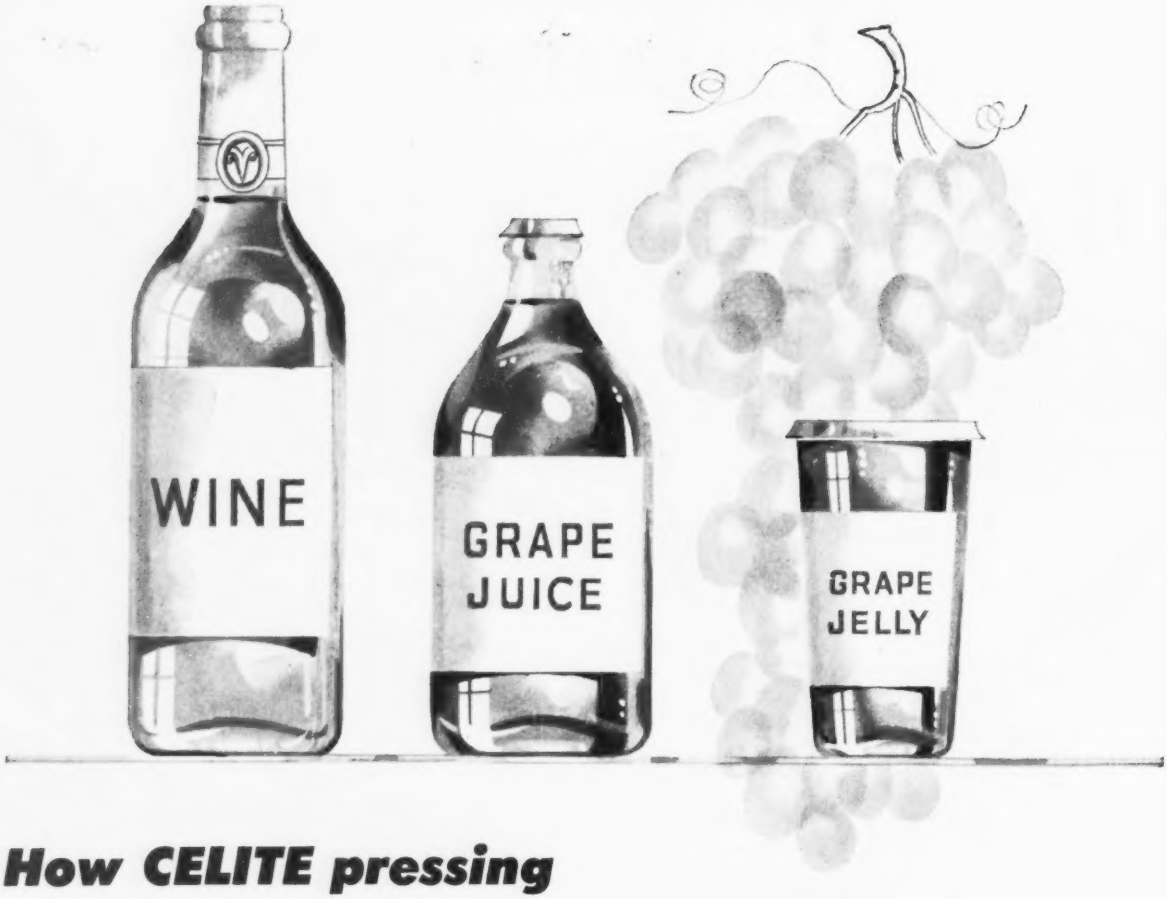

How CELITE pressing

and filter aids make grape products less costly and more saleable

YOU can reduce the overhead of your pressing operation with Celite* Pressing Aids . . . and improve your quality for faster sales with Celite Filter Aids.

For maximum juice yield from your presses, a small amount of Celite should be used as a pressing aid. Celite Pressing Aids help produce a firm dry cake which can be easily and completely stripped from the cloth.

In addition, you can secure grape products with high brilliancy and sparkling clarity, because Celite Filter Aids remove *all* suspended impurities. The result is a product with more eye-appeal . . . more "buy" appeal.

All these advantages result from the inherent properties of Celite itself. Carefully processed from the purest deposits of diatomaceous earth, Celite is a light weight, porous powder. It is chemically inert, insoluble, and specially treated so that it imparts no foreign flavor to organic products.

Celite has long been used to improve product quality and speed the processing of sugar, fruits and juices, beer and wine and many other beverages and foods. It will pay you to investigate the many advantages of the use of Celite Filtration for your own products.

A Celite Field Engineer will gladly consult with you. For his services—at no obligation to you—simply write to Johns-Manville, Box 60, New York 16, N. Y. In Canada 199 Bay Street, Toronto 1, Ontario.

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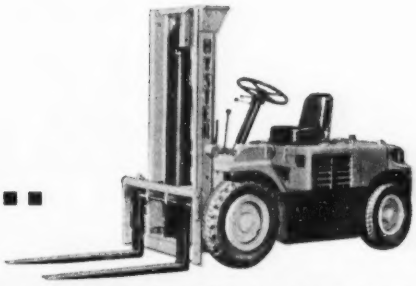
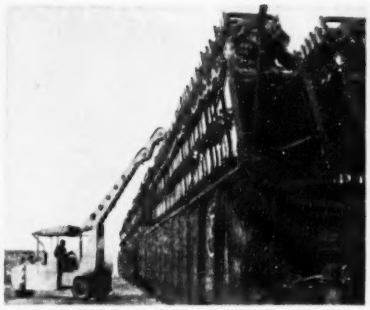


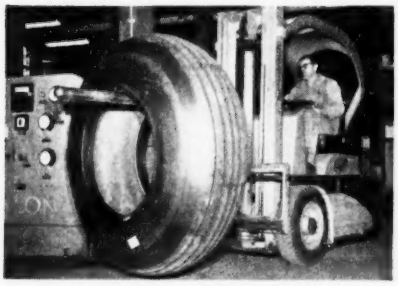
Paper-roll Load-Grab



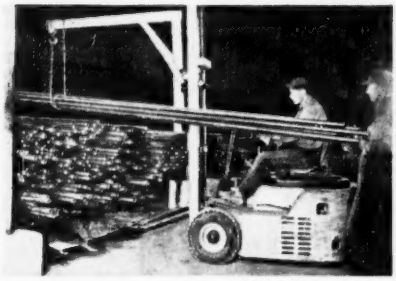
Karry Krane with Boom Extension

4-Barrel Load-Grab

Scoop—for loose aggregates.



Ram—for tires, rolls, spools, etc.



Boom—for odd shapes, light crane work.

you can add... HYSTER attachments

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Are your materials hard-to-handle? The right Hyster® Truck Attachment — and Hyster offers more than 100 of them — frequently is the *key* to greater profits.

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Your Hyster Dealer is a specialist in reducing materials handling costs. He can recommend the correct lift truck practices for *your* materials.

Make the Hyster Lift Truck your *basic* materials handling tool—to it add the right cost-reducing attachments. Call your Hyster Dealer today, or write for Catalogs 1266, 1219, 1258 to:

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B-W VORTEX Assures AUTOMATIC EFFICIENT ECONOMICAL food processing

The famous Barry-Wehmiller Vortex is today being successfully used by more and more food processors in a wide variety of applications. Whether your processing requirements include cooling, freezing, pasteurizing or exhausting, you'll find the Vortex perfectly adapted to glass or metal containers for foods or beverages.

Operation of the Vortex is entirely automatic and continuous. Accurate dial control of operating speed assures correct processing time. Compact design conserves valuable floor space, and its gleaming, modern appearance appeals to the eye.

Engineering advantages include the patented B-W "walking beam" conveyor which moves containers through the process zone, yet the conveyor itself remains at the same temperature throughout the operation. This eliminates the usual cost of heating, cooling or re-heating the conveyor system. Hydraulic drive eliminates many gears and cam movements and has extremely low power requirements.

For many years of the most efficient, economical processing in your plant, specify the Vortex. Write for complete data and Bulletin 302 today.

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BARRY-WEHMILLER MACHINERY CO.

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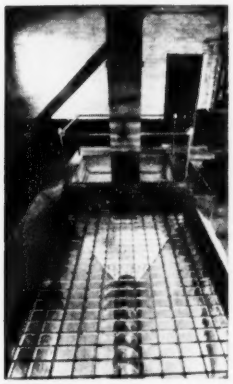
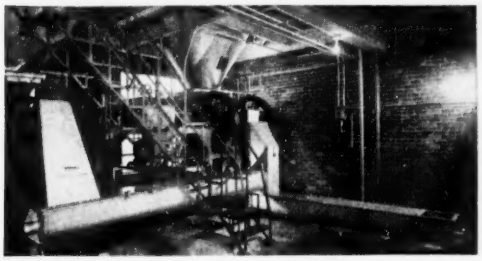
B-W GREAT BRITAIN BARRY-WEHMILLER MACHINERY CO. (LTD.) MILL GREEN ROAD

Handles spent wet brewers grains at high capacity, low cost

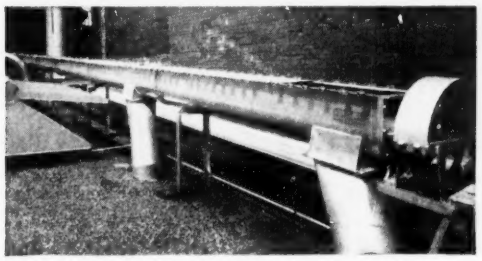


1 Truck dump hopper has integral screw conveyor to feed wet spent grain.

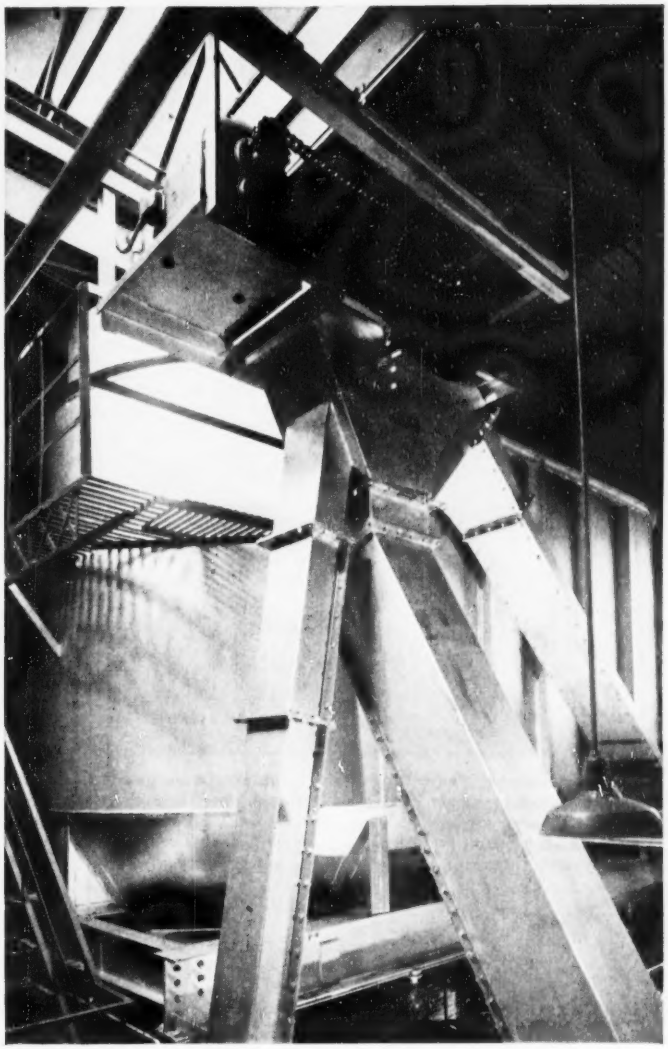
2 Granitized high-speed buckets are used in centrifugal bucket elevator.



3 Pressed brewers grain is moved from presses and hoppers to first dryer by these screw conveyors.



4 Another Link-Belt screw conveyor distributes wet spent grain to holding tanks of second dryer.



5 Triangular path Link-Belt Bulk-Flo feeder-conveyor-elevator discharges pressed grains to second dryer at the F. L. Emmert Co. plant.

LINK-BELT engineering gives F. L. Emmert Co. a compact, modern system

LIKE many other plants all over the country, F. L. Emmert Co., Cincinnati, Ohio, relied on Link-Belt to engineer their complete handling system (see photos). The result is a high capacity, economical process. Not only does Link-Belt build all sizes and types of conveying and power transmission machinery—it also offers unequalled facilities for planning, building and erecting, if desired, complete handling systems. If your plant requires more efficient movement of bulk or packaged materials, call the Link-Belt office near you. We will be glad to analyze your needs . . . with no obligation, of course.

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LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle; Scarboro, Toronto and Elmira, Ont. (Canada); Springs (South Africa); Sydney (Australia). Sales Offices in Principal Cities.

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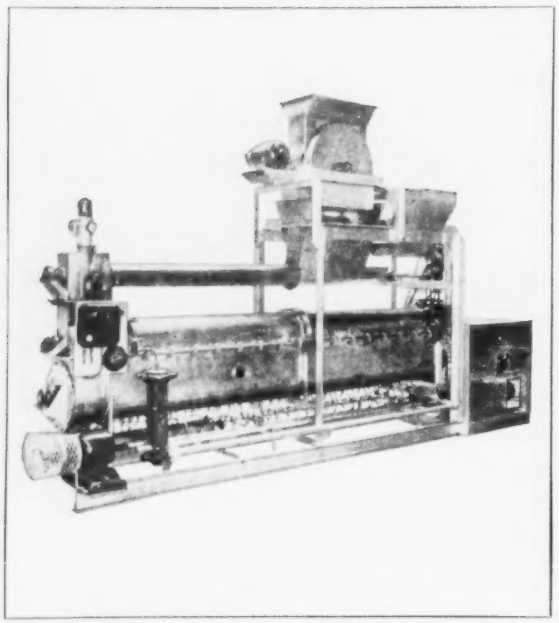
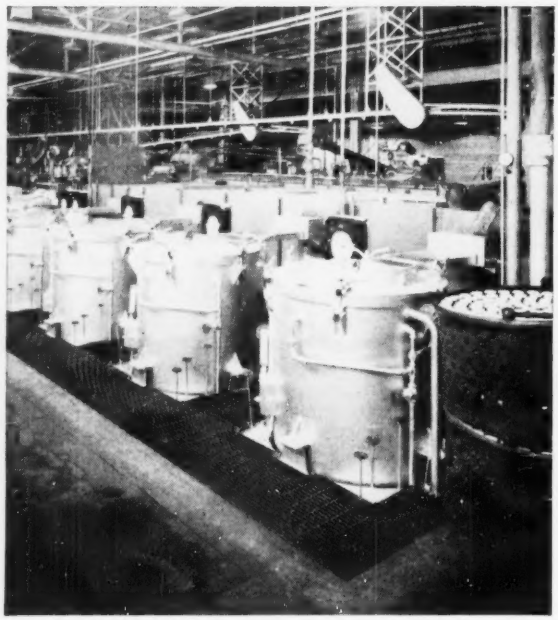
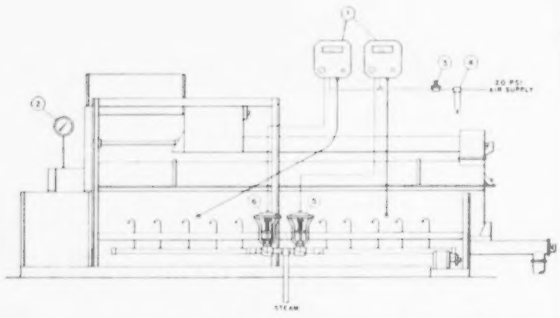
CAN IT



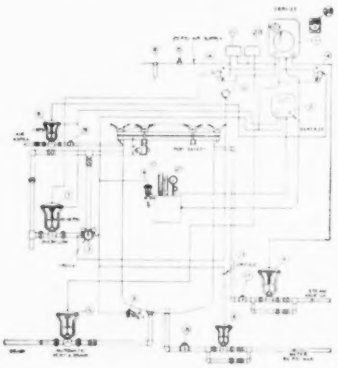
Taylor Apple Cooker Control System for applesauce or any open cooker temperature control. Completely sterilizes the product in the shortest time and with minimum steam consumption. No discoloration, "mushing", "pulping", poor flavor or spoiled product due to improper cooking temperatures.



W-5T Control System for water processing glass packages. Provides positive circulation for uniform cooling and cooking with minimum air consumption. Automatically times cooking period, signals end of cook. Pressure inside retort maintained in positive relation to pressure in containers.



Drawing above illustrates the operation of the Apple Cooker Control System. Desired sterilization temperature is maintained by admitting only sufficient steam for cooker radiation and final heat penetration.



Controlled pre-heated water prevents thermal shock to containers. Controls pressure throughout cycle, also processing temperature. Automatically times period, signals end, and shuts off steam.

TAYLOR INSTRUMENTS

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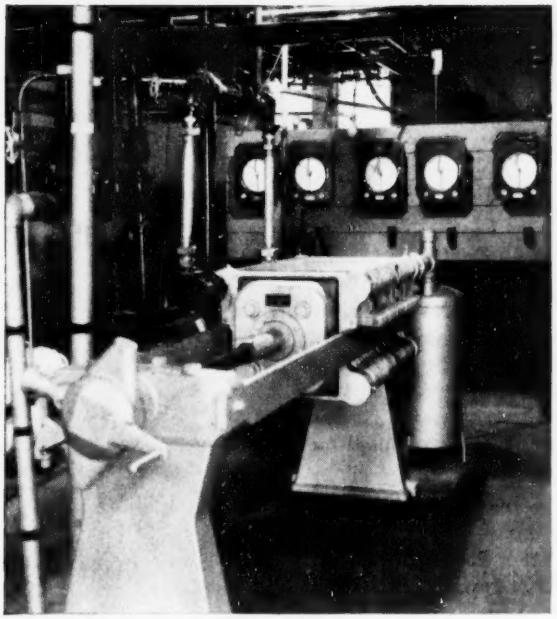
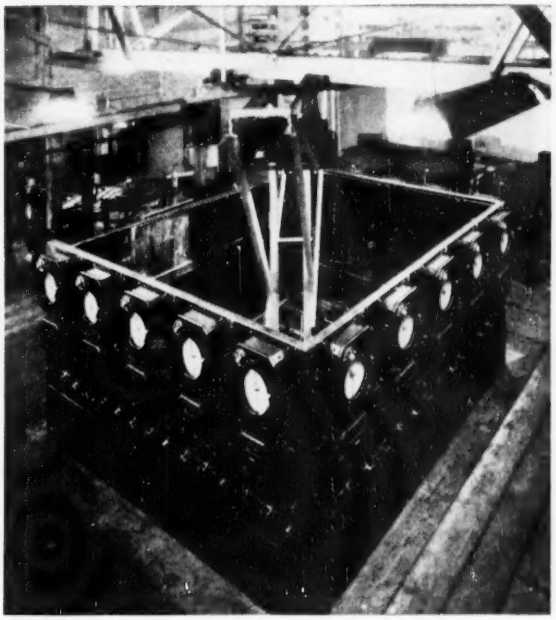
BETTER, CHEAPER WITH THESE TAYLOR CONTROLS

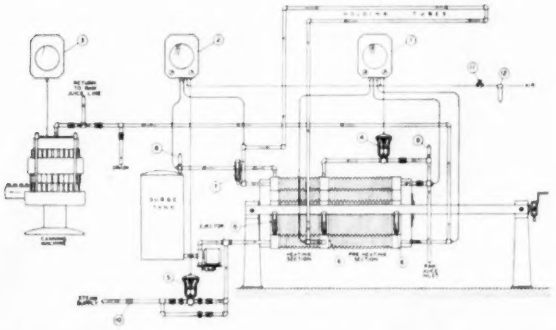
There are automatic control systems designed for each key process in your plant. Write for **Catalog 500** for the complete story of Taylor Instrumentation for the canning industry—or call in your Taylor Field Engineer. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.



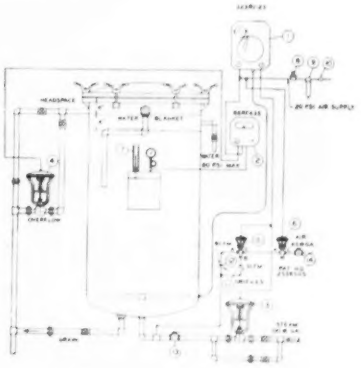
Taylor Juice Heater Control System for short-time, high temperature juice heaters precisely maintain final juice temperature even during complete stoppage of flow. Result: uniformly high quality, steam savings, minimum operator attention. Available for steam or water type (shown above) heaters.



The SP-6AV System for steam cook with pressure cooking has increased production capacity up to 20% for many users. For No. 2½ cans or larger. Completely automatic. Operator simply loads retort, sets the timer dial. Signal lights indicate when retort is ready to be unloaded.



In water type Juice Heater Control System, temperature of the circulating water and pasteurized juice are recorded and controlled. It records temperature of raw juice, holding tube return, filler bowl and water to surge tank.



SP-6AV. Automatically controls processing cycle, venting on a time and temperature basis, pressure control during cooling, admission and shut-off of water, blows down retort.

MEAN ACCURACY FIRST

For more information, use coupon on page 207.

Illustrated is Versicon—one of Thermoid's "Basic Five". A true all-purpose hose for handling air, water, oil or welding gases.

When you are in need of hose—
Suggest you look at Thermoid!

See how extra strength is built into each length—with either tough rayon cords or special cotton fabric. Abrasive resistant—light—easily handled—resists kinking—designed for maximum service. Whether it be one of Thermoid's multiple service types or a hose designed for a specific use, your Thermoid Distributor can recommend the type best suited for your particular requirements.

Call your Thermoid Distributor. He has complete information on all types of Thermoid Hose and other Thermoid products. Our experienced Sales Engineers are available for help with unusual problems.

Thermoid
Industrial Rubber Products
Quality Service

It will pay you to specify Thermoid.

Conveyor & Elevator Belting • Transmission Belting
F.H.P. & Multiple V-Belts • Wrapped & Molded Hose

Thermoid

Rubber Sheet Packings • Molded Products
Industrial Brake Linings and Friction Materials

Thermoid Company • Offices & Factories: Trenton, N. J., Nephi, Utah

For more information, use coupon on page 207.

Good Taste

MAKES SALES SOAR

STANGE

CREAM·OF·SPICE

SEASONINGS

Flavors America's Finest Food Products

© 1953 WM. J. STANGE COMPANY

CHICAGO 12, ILL. • OAKLAND 21, CALIF.
In Canada: Stange-Pemberton, Ltd.
New Toronto, Ont. Printed in U.S.A.

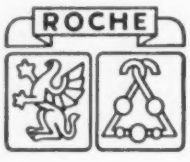
—to promote better health

TO promote better health, mere enactment of laws is insufficient. Experience has shown that effective education of the public in nutritional matters depends to a great extent on the dissemination of the principles of nutrition, food values and related subjects. If the public is properly educated, it will naturally prefer the *improved* staple foods over those which are lacking in good nutritional value.

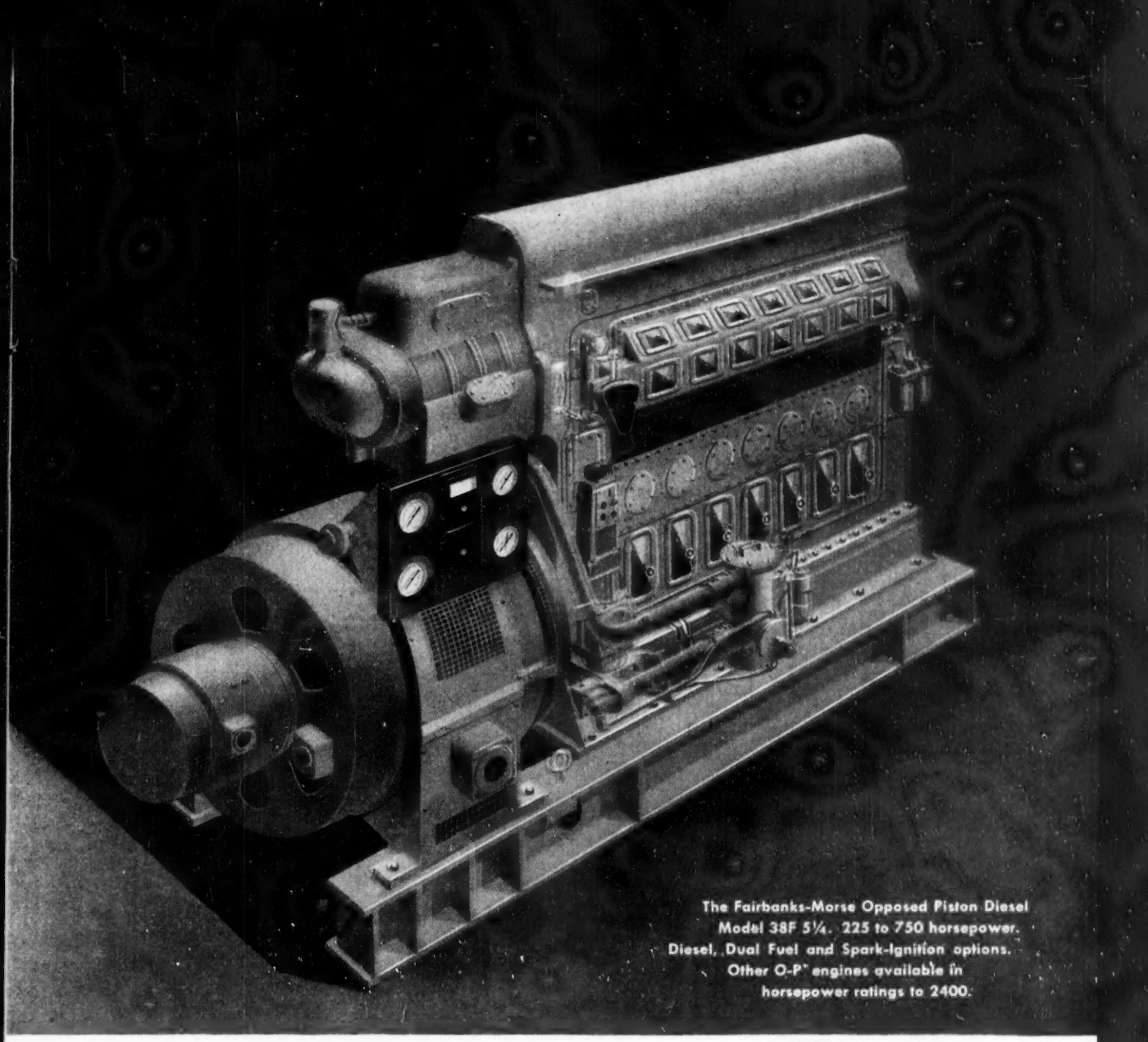
THE practice of enriching or fortifying foods for better health is becoming more widespread. For example, enrichment of many cereal foods, the fortification of certain fruit and vegetable juices, and of margarine, are accomplished facts in the United States. The list lengthens because food processors know that, fundamentally, the most important factor in foods is nutritive value. So they are making their good foods better—to the benefit of millions of people.

THE firm of Hoffmann-La Roche has for many years pioneered in the production of vitamins for the food and other industries throughout the world. These vitamins, synthesized by chemists, are identical with those existing naturally and are manufactured on a large scale at a much lower cost than if they were extracted from natural sources. These are the vitamins that are used for flour and bread enrichment, the process which to a great extent restores important nutritional values which are unavoidably lost in the milling and processing of wheat when fine, white flour is produced. Rice, corn and other cereal grains are similarly restored and fortified.

ROCHE has experts in many fields and is now offering their experience to you. You are cordially invited to discuss enrichment with us.



HOFFMANN-LA ROCHE INC.
VITAMIN DIVISION
Nutley 10, New Jersey



The Fairbanks-Morse Opposed Piston Diesel
Model 38F 5¼. 225 to 750 horsepower.
Diesel, Dual Fuel and Spark-Ignition options.
Other O-P* engines available in
horsepower ratings to 2400.

. . . always a need for something *Finer*

It was designed and built without thought of price . . . built only to give the maximum of heavy-duty horsepower in a minimum of space . . . plus an unvarying reliability upon which you could stake a balance sheet of operating costs and profits.

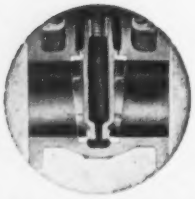
The price?

Not quite as low as conventionally designed and conventionally manufactured engines, but low enough to insure that no one who wants and needs an engine which gives more, need forego its ownership. For the more difficult tasks of producing power, this engine is a fulfilling answer.

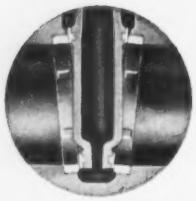
Fairbanks, Morse & Co., Chicago 5, Illinois.

FAIRBANKS-MORSE
a name worth remembering when you want the best

DIESEL AND DUAL FUEL ENGINES • DIESEL LOCOMOTIVES • RAIL CARS • ELECTRICAL MACHINERY • PUMPS • SCALES • HOME WATER SERVICE EQUIPMENT • FARM MACHINERY • MAGNETOS



Straight-Flow Port Design reduces fluid turbulence to a practical minimum.



Seat Rings of end-seated type are screwed into the body.

Sure-Grip Malleable Handwheel for non-skid gripping even with heavy gloves.

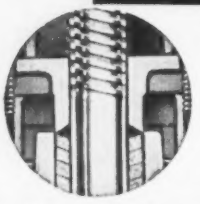
WALWORTH

iron body gate valves

with screwed or flanged ends

... 8 Outstanding Features

For complete information on these new Walworth Iron Body Valves, see your local Walworth distributor, or write for bulletin 106.



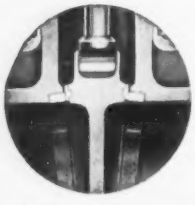
Brass Liner on Glands assures greater resistance to corrosion and scoring.

WALWORTH

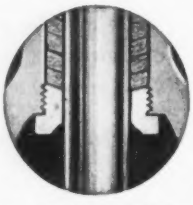
valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

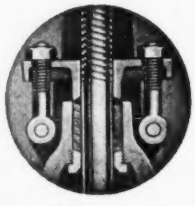


T-head Disc-to-Stem connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.

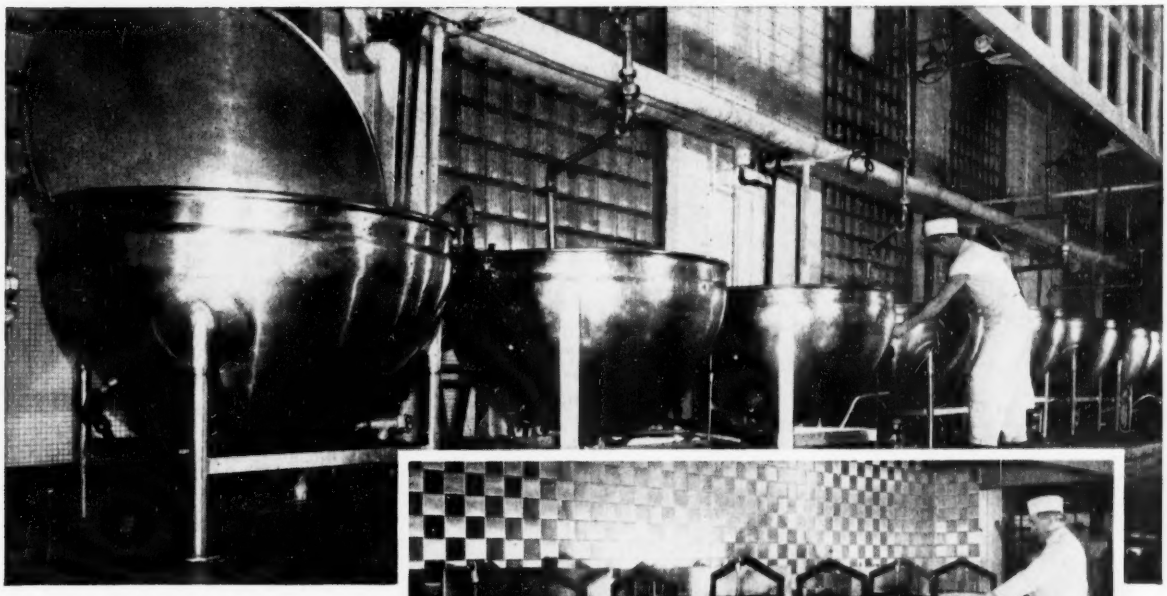


Bronze Back-Seat Bushings in bonnets of OS&Y valves.

Solid Web Type Disc in OS&Y valves for greater strength and longer service.



Hinged Gland Eye-Bolts on OS&Y valves permit faster, easier repacking under full pressure.



TWENTY OF THESE 150-200 gallon steam-jacketed kettles in the Commissary are Stainless Steel. Pitting and staining are eliminated, as are heavy scrubbing and wear, through use of Stainless. The kettles were made by Lee Metal Products, Philipsburg, Pa., B. H. Hubbert & Son Manufacturing Co., Baltimore, Md., and Groen Manufacturing Co., Chicago, Ill.

ENCASED IN STAINLESS STEEL cabinets, these three Pitman Frialators are used for preparing such fried foods as crabcakes and fishcakes. Cleanliness and the need to keep food true-flavored and fresh dictated the use of Stainless Steel here.

Behind the Automats

YOU CAN'T BEAT STAINLESS STEEL

THE New York commissary of Horn and Hardart Company—operators of the famous Automats—is considered a showplace of efficient, sanitary processing of food products. An important reason for this reputation is that as much as 75% of the equipment in key departments is Stainless Steel.

Steam-jacketed kettles in which soups, gravies and vegetables are cooked interchangeably are Stainless. The first Stainless kettles were installed in 1940 and have an anticipated life of 20 years. There's no pitting, no staining, cleanup is easier and there's no wear from paddles used in stirring.

Sauces and fillings for beef and chicken pie are not only cooked, but cooled, too, in Stainless tilting kettles. After cooking, water (cooled to 40°) replaces steam in the extra-large jackets.

Fried foods, such as crabcakes, fishcakes and the like, are prepared in gas-fired fryers installed 16 years ago. Stainless Steel used in the case is easy to clean and helps maintain the true flavor of the food.

Manned by a crew of 7 men, a straight-line pie machine made almost entirely of Stainless Steel turns out 1700 to 1800 pies per hour. Stainless Steel's ease of cleaning helps in changes from one type of pie to another.

These are only a few of the uses of Stainless Steel in this modern plant. In these and many similar types of jobs in your plant, Stainless can cut down cleaning and changeover time and make operations more efficient. And for finest performance, be sure your equipment manufacturer uses U·S·S Stainless Steel.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO · NATIONAL TUBE DIVISION, PITTSBURGH
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S STAINLESS STEEL

USS

SHEETS · STRIP · PLATES · BARS · BILLETS
PIPE · TUBES · WIRE · SPECIAL SECTIONS

UNITED STATES STEEL

For more information, use coupon on page 207.

A message to food-plant suppliers . . .

Make the whole food industry your market!

Here is one of the most important stories in marketing history

Bakeries, breweries, canneries, dairies, meat plants—other food plants—are no longer a group of largely unrelated industrial markets. They are *one industry*, the manufacturers and processors of what we eat and drink — the *whole food industry*.

Here's what has happened . . .

Faced with soaring costs and the production requirements of the fastest population growth in recent U. S. history, food plants are being caught and swept forward by three highly-significant trends:

FIRST TREND —*a tidal wave of engineering*. Hand methods, batch methods, are giving way to engineered, continuous methods. New machines and new fully-engineered processes—unheard of a decade ago—are becoming commonplace today. And each *kind* of food plant is actually adopting the equipment and methods of the others. Fruit processors are using "brewery equipment," candy makers are using "ice cream equipment," pie bakers are using "beverage equipment," to name just a few examples. Not surprising . . . for the tidal wave of engineering has finally proved to food plants of all kinds that most of their problems are basically identical . . . problems in separating, mixing, heating and cooling, forming, packaging, materials handling, sanitation, power transmission, and many other operations. The *tidal wave of engineering* has brought food plants together into a *whole food industry*.

SECOND TREND—*consolidation.* Here at last is the trend that hit other industries years ago—the competitive elimination of the inefficient. In 1947 there were 37,000 food-manufacturing firms; today there are less than 23,000—*a 37% drop in 6 years.* Since production has increased over this same period, these figures indicate an *important concentration of buying power.*

THIRD TREND—*diversification.* It can be demonstrated that today *well over half* of all manufactured food volume is produced by companies operating in more than one branch of the food industry—thousands of companies and plants, large and small. That's the natural result of a drive for lower overhead on seasonal products, for new profits through new products. This trend is shaping a *simplified sales target* for industrial advertisers.

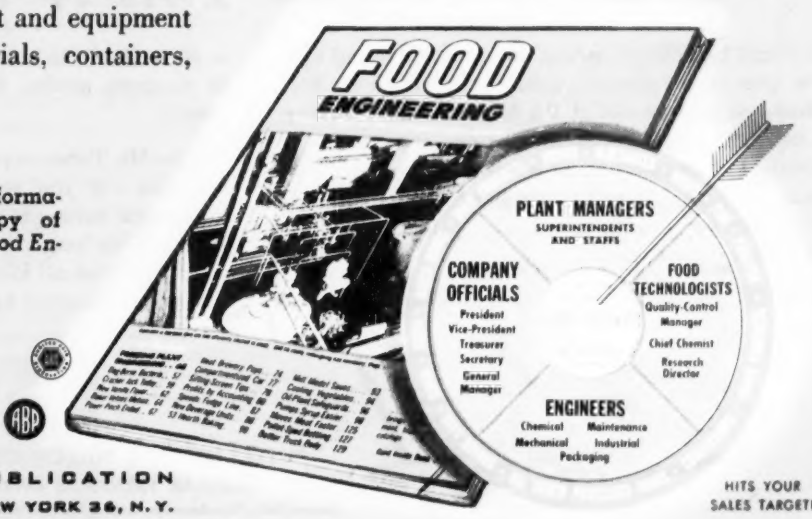
IT'S A WAKING GIANT—one of the largest industries in the world, doing over $40 billion business annually—modernizing intensively, knitting itself into a single, united market . . . for *your* special or general industrial products. The *whole food industry* spends from $750 million to $1 billion annually for plant and equipment —$25 billion for materials, containers, parts, and supplies.

Advertisers—for more information, send for a free copy of "Food's Hot," the story of *Food Engineering* and its market.

ONE MAGAZINE is designed to help you sell to the *whole food industry:* FOOD ENGINEERING. Its name defines its function—to help each kind of food plant use the experience of the others, to help *all* food plants solve their common problems, as they seek to engineer quality products at lower cost.

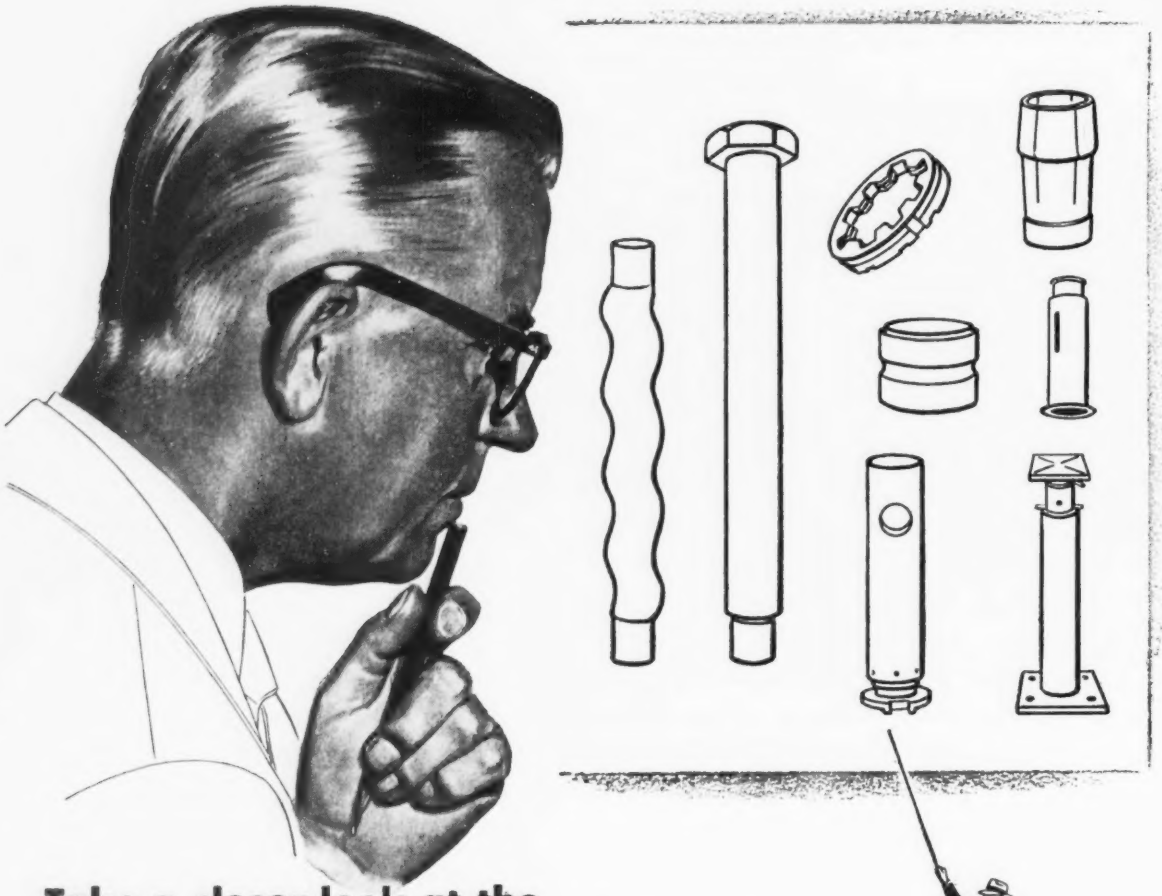
Over 300 advertisers are using *this* approach to sales in the *whole food industry.* They have good reasons! FE's *all-paid* circulation has tripled in 12 years. The men who buy in food plants vote FE tops *in every industry-wide readership poll.* FE carries far more advertising than any other industry-wide food-plant magazine, and that volume is rapidly growing. And, if you want to receive inquiries from your advertising, you will be interested in the fact that many advertisers say FE outpulls all other magazines.

If you sell to any part of this giant industry—or if you have never before considered its total potential—let us show you the Big Picture of food industry sales for *your* products.



HITS YOUR SALES TARGET!

A McGRAW-HILL PUBLICATION
330 WEST 42ND STREET, NEW YORK 36, N. Y.



Take a closer look at the

ADAPTABILITY

of B&W mechanical tubing *You'll like it*

It would be difficult indeed to name any round hollow part or structural assembly that can't be *machined* or *formed* out of B&W Mechanical Tubing – at worthwhile economies in time, costs and materials. It will pay you, as it has so many others, to look into its great versatility and the opportunities it affords for cutting production expense and improving product quality.

B&W Mechanical Tubing—both seamless and welded – is available in stainless, alloy and carbon steels, in tempers, grades, finishes and sizes to suit any needs.

Call on Mr. Tubes – your nearby B&W Tube Representative – if you want help in determining the mechanical tubing best suited to your needs. Get the benefit of his long, close association with mechanical applications of all kinds to help you cut costs while keeping production high.

B&W SEAMLESS and WELDED TUBES

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing

TA-1747(C)

Now! Soy Sauce in a pouch bag!

made possible by

Du Pont ALATHON*

polyethylene resin

Pouch bag for Chinese soy sauce given strength, flexibility and leak-proof heat-seal with coating of "Alathon"

This single-service pouch bag for liquid soy sauce is an example of how Du Pont "Alathon" polyethylene resin can be used to help solve many complex packaging problems.

To successfully package soy sauce in a pouch bag, the bag must be strong, flexible and moisture-resistant. The bag must resist deterioration from the oils in the sauce. It must have a leak-proof heat-seal, yet be easy to open without spilling. And, of course, any materials used must be tasteless, odorless and non-toxic.

A pouch bag constructed of a special paper made on a glassine machine with a 3-mil coating of Du Pont "Alathon" polyethylene resin on the inside fulfilled every requirement. "Alathon" in this thickness gave the bag extra strength and insured a leak-proof heat-seal. In addition, it helped make possible the ingenious tear-strip pouring spout at the top of the bag.

Because of its unique combination of properties, "Alathon" has helped develop many new packaging ideas. "Alathon" is tough and flexible over a wide range of temperatures—from tropical heat to 70° below zero... resists acids, alkalies and many greases. Consider the advantages "Alathon" offers in multi-ply, duplex or single-ply bags, chipboard containers and trays, fiber drums and cartons.

*REG. U.S. PAT. OFF.

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

Polychemicals
DEPARTMENT
PLASTICS • CHEMICALS

WRITE FOR FREE BOOKLET

describing the properties and uses of "Alathon" in the packaging field, or simply mail this handy coupon. We'll gladly put you in touch with sources of supply for packaging materials coated with "Alathon."

E. I. du Pont de Nemours & Co. (Inc.)
Polychemicals Dpt. 5410, Du Pont Bldg., Wilmington 98, Del.

Please send me the new booklet on packages using coatings of "Alathon."

Check type of package most interested in: Multi-wall bags ( ). Single-ply and duplex bags ( ). Pouch bags ( ). Fiber drums & cartons ( ). Chipboard containers & trays ( ). Overwraps and innerwraps ( ). Other ( ).

Name_____

Title_____

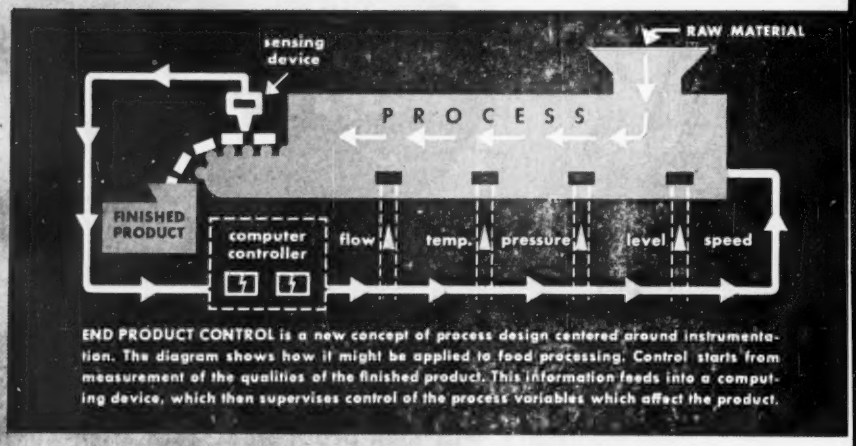
Company_____

Address_____

City_____ State_____

For more information, use coupon on page 207.

In the food plant



END PRODUCT CONTROL is a new concept of process design centered around instrumentation. The diagram shows how it might be applied to food processing. Control starts from measurement of the qualities of the finished product. This information feeds into a computing device, which then supervises control of the process variables which affect the product.

# of tomorrow–

Honeywell instrumentation will implement new processing techniques

THE RAPIDLY expanding technology of the food industry has already marked notable milestones in processing which help to point the course of the industry's future. And in many of these, instrumentation by Honeywell has played an important part.

The concentration and freezing of citrus juices, aseptic canning, and automatic cream neutralization are but a few of the many examples of developments which advanced instrumentation has helped to make possible. Today, scores of food processes produce more . . . produce better . . . because they are controlled accurately and automatically.

What of tomorrow?

New processes, new plants, new foods . . . all will be aided by the contributions of instrumentation, to an ever-increasing extent. For instrumentation offers limitless possibilities for the food industry . . . possibilities whose surface has yet been hardly scratched.

Today, for example, measurement and control are indirectly related to the product; they deal with temperatures, pressures and other variables which affect the process. Tomorrow may see the growth of Honeywell control systems which taste the flavor of the finished product, inspect its color, feel its texture, or evaluate its bacteriological purity. These systems, which may involve wholly new concepts of instrumentation, could then regulate the food processing equipment so as to produce the desired measured qualities in the end product.

This is but one facet of the role of instrumentation in the future of food processing. There are countless others . . . bold strokes of imagination today, but solid reality tomorrow . . . which Honeywell will explore in cooperation with forward-looking food technologists.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4502 Wayne Ave., Philadelphia 44, Pa.

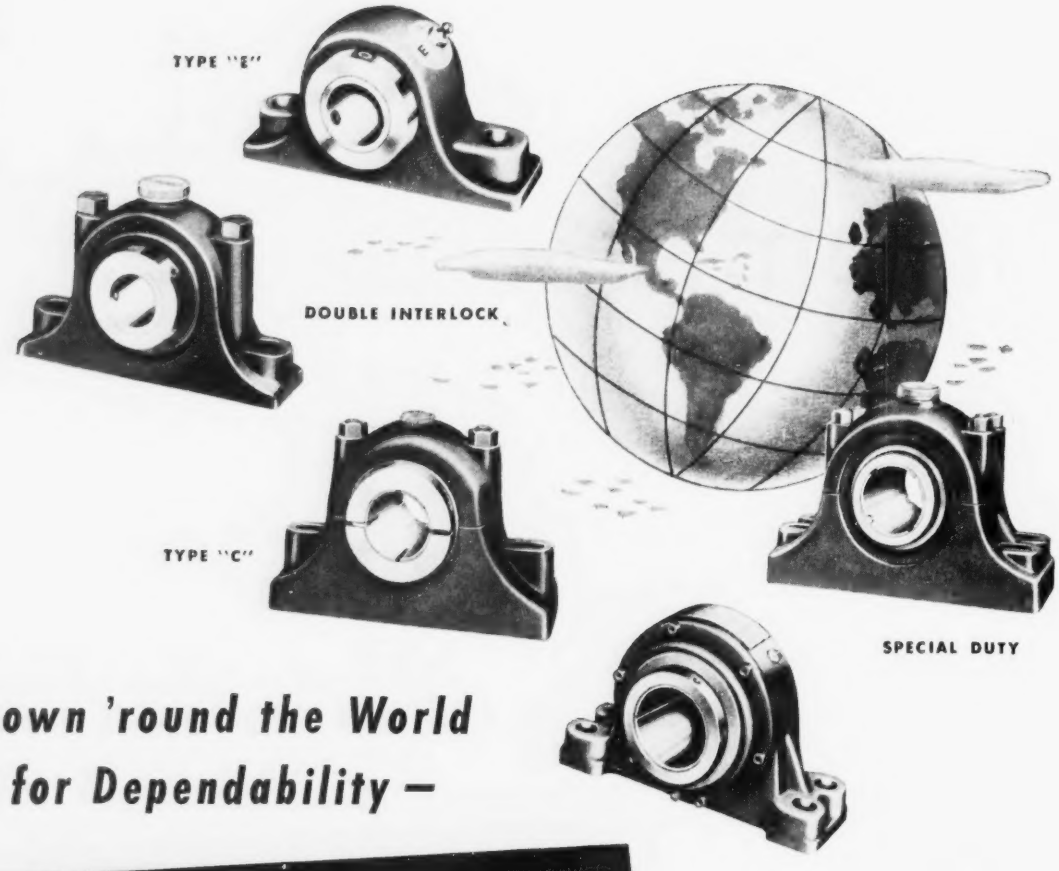
● **REFERENCE DATA:** For a challenging discussion of the future role of instrumentation, write for your copy of a paper entitled "How Automatic Can We Get?"

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

Food plant design by The Austin Company anticipates new demands of the future.



Known 'round the World for Dependability —

DODGE-TIMKEN

★ In millions of installations Dodge-Timken bearings have proved their ability to cut costs and increase production. Their dependability is unquestioned under every condition of service. Available in five different types, including the new Dodge-Timken All-Steel Pillow Block for grueling, heavy duty jobs. All are sealed both on and off the shaft.

Dodge-Timken bearings are fully assembled and lubricated — ready to lock on the shaft. They are normally available from distributors' stocks . . . in a wide range of sizes. Call your distributor or write us for Dodge-Timken bulletins.

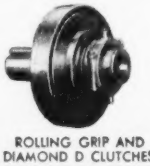
DODGE MANUFACTURING CORPORATION
2800 UNION STREET, MISHAWAKA, INDIANA

DODGE
of Mishawaka, Ind.

1878 DODGE 1953 75th ANNIVERSARY

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory-trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified telephone book.

TORQUE-ARM SPEED REDUCERS



ROLLING GRIP AND DIAMOND D CLUTCHES

TAPER-LOCK SHEAVES; SEALED LIFE V-BELTS

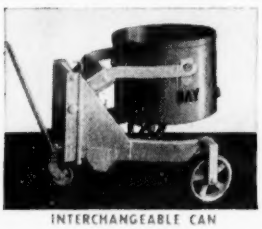
IN MIXING EQUIPMENT

DAY means longer life span

DAY 100-gal. gearless type pony mixer at Eli Lilly & Co., Indianapolis, Indiana

✲ DAY combines rugged construction with precision engineering. That's why DAY Pony Mixers are delivering *extra* years of trouble-free, economical operation in plant after plant. DAY features result in higher production at a lower cost, protect the quality and uniformity of your product. An important feature is the interchangeable can unit—eliminates delay between batches. Lift truck with hand pump hydraulic lift unit is optional equipment. DAY planetary mixing action plus agitator blade contouring delivers radial and lifting mixing action over depth of can. DAY rugged construction is unique. A one-piece heavy cast iron frame assures absolute rigidity, quiet operation. Mixers are driven by time-tested internally geared head motors through roller chain and sprockets enclosed in dust tight guards, exclusive with DAY. Whatever your requirements, there's a dependable DAY pony mixer engineered to do your job — better — more economically. For complete information, call your nearest J. H. Day field engineer, or write direct for Bulletin 500.

RUGGED CONSTRUCTION



INTERCHANGEABLE CAN

DEPENDABLE DRIVE

FOUNDED 1887

when you buy DAY *you buy dependability*

THE J. H. DAY COMPANY

INCORPORATED

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PRODUCERS OF QUALITY EQUIPMENT FOR BAKING • PAINT & VARNISH • CHEMICAL FOOD • RUBBER • PHARMACEUTICAL • COSMETICS • PAPER & PULP • EXPLOSIVES CERAMICS • CANDY • SOAP • SUGAR • MILK PRODUCTS • OTHER MAJOR INDUSTRIES

A SIGN OF GOOD JUDGMENT

Automatic
FORMING, FILLING and SEALING MACHINE

The big climb in non-fat dry milk retail sales is due, in part, to the smart new individual packets which offer the housewife greater convenience in serving and handling. An effective example of this new styling is the Maple Island four-seal packet, formed, accurately filled and tight-sealed on a STOKESWRAP to make one quart liquid skim milk.

The STOKESWRAP handles printed or unprinted cellophane, pliofilm, polyethylene and other heat-sealing paper or foil. Various feed mechanisms are available for packaging a wide variety of products by pill feed, pocket feed, auger or liquid feed.

Write us about your packaging problem and send a sample of your product. Our package engineering department will offer sound suggestions with no obligation.

This appealing Dry Milk pillow type packet is another example of neat, sales-appealing packaging by the Stokes & Smith STOKESWRAP.

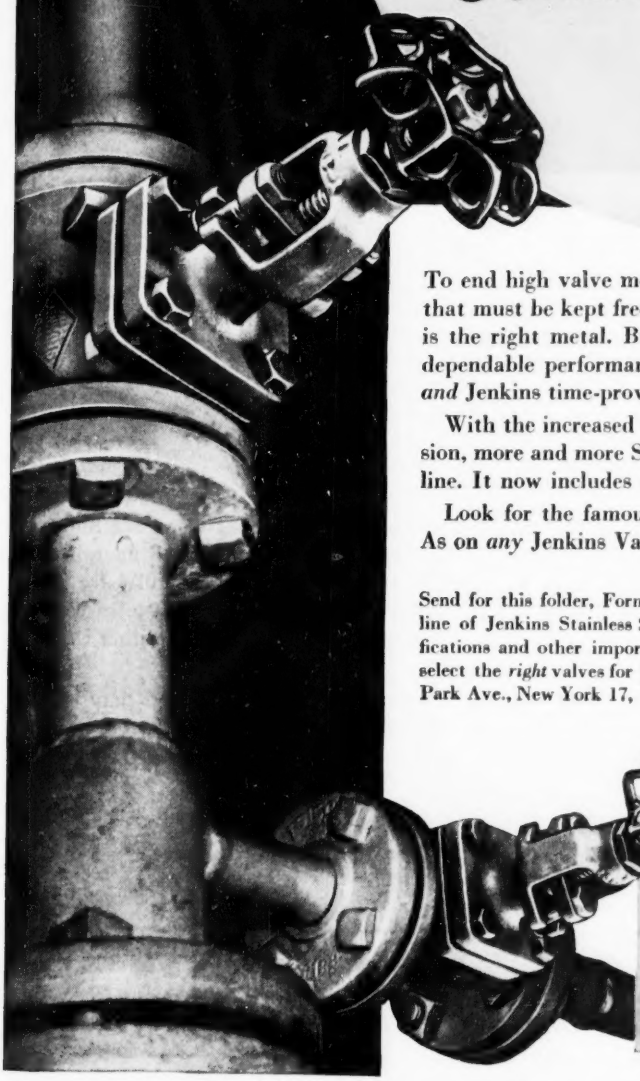
← Helpful illustrated STOKESWRAP Catalog sent promptly upon request.

STOKES & SMITH CO.
4911 SUMMERDALE AVENUE, PHILADELPHIA 24, PA.
Pacific Coast: SIMPLEX PACKAGING MACHINERY, INC., 534 - 23rd AVE., OAKLAND 6, CALIF.

SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION
fmc TRADE MARK

Here's the hookup for valve-killing corrosive services...

Stainless Steel PLUS Jenkins Quality



To end high valve mortality from corrosive liquids, and to control fluids that must be kept free from contamination or discoloration, stainless steel is the right metal. But it takes more than metal to make a valve. For dependable performance, you need the two-way hookup—Stainless Steel *and* Jenkins time-proved Valve Engineering.

With the increased demand for processing equipment that resists corrosion, more and more Stainless Steel Valves have been added to the Jenkins line. It now includes types and sizes to meet most industrial needs.

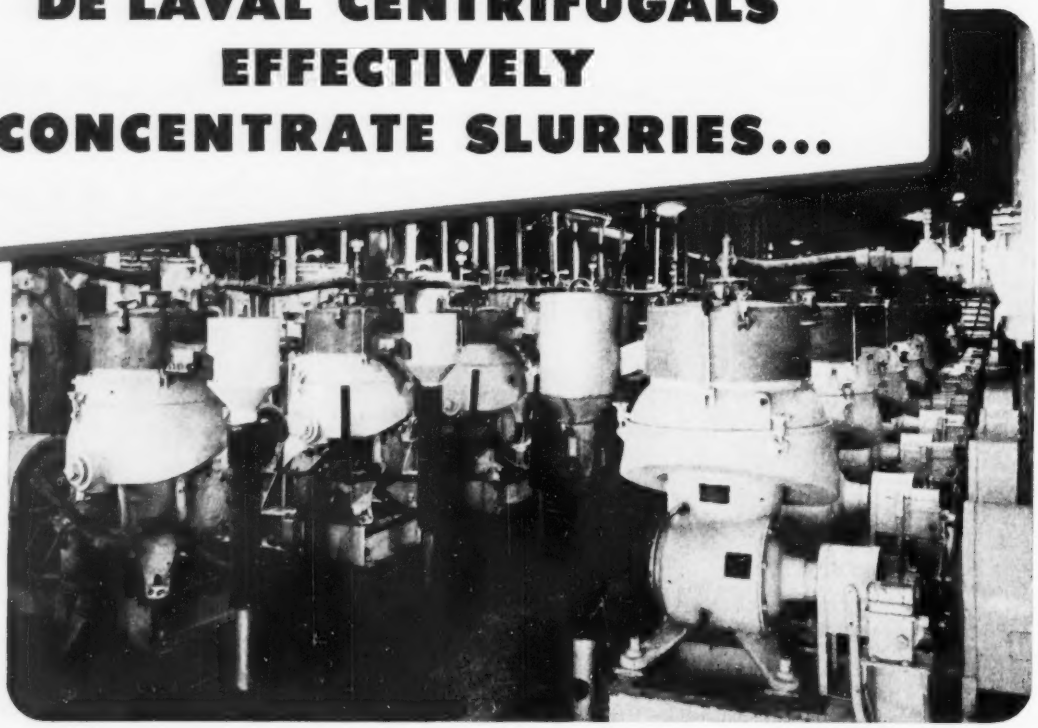
Look for the famous Diamond trade-mark on valves of stainless steel. As on *any* Jenkins Valve, it means extra years of trouble-free service.

Send for this folder, Form 194, describing the complete line of Jenkins Stainless Steel Valves. It contains specifications and other important data that will help you select the *right* valves for your plant. Jenkins Bros., 100 Park Ave., New York 17, Jenkins Bros., Ltd., Montreal.

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864

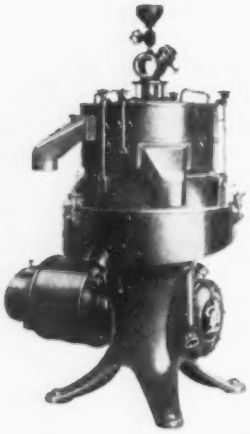
SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE

DE LAVAL CENTRIFUGALS EFFECTIVELY CONCENTRATE SLURRIES...



...These Are Dewatering Gluten

What Is Your Problem?



The concentration of gluten is very effectively done by means of De Laval Separators. Many slurries, in fact, respond to the separating action of centrifugal force when filters or gravity produce little or no effect. Moreover, the successful centrifuging of a mixture automatically means time saved, for the action of centrifugal force is continuous. Gluten is only one more example of a substance that can be thickened both quicker and better centrifugally.

In the past forty odd years, De Laval engineers have solved hundreds of separating and concentrating problems. Many such problems have been in a field where the machines have continued to operate successfully for years. Some have been tests made in the laboratory only—but these tests too, are valuable, for the products involved may closely resemble the product that ***you*** wish to separate, concentrate or clarify.

It may pay you well to consult a De Laval engineer. You may be able to put the collective knowledge of The De Laval Separator Company, which is available to you through him, to work for you.

THE DE LAVAL SEPARATOR COMPANY
Chicago POUGHKEEPSIE, N.Y. San Francisco

DE LAVAL FOR FASTER PROCESSING SYSTEMS

For more information, use coupon on page 207.

"Naturally," Food Sells Better...

When You Sell

NATURAL FRESH FLAVOR

intensified by Zest®

ZEST brings out the true garden-fresh flavor that nature put *into* your vegetables . . . prevents the gradual "flavor-fading" that may be robbing your brand of profit-making taste appeal. Step up quality with fuller flavor. Add ZEST, Staley's 99+% pure monosodium glutamate, to your canned and frozen vegetables, soups, fish, stews, poultry . . . and scores of other foods.

ZEST intensifies natural flavor *already in* your foods without adding flavor, aroma or color of its own. Freezing reduces the level of amino acids. ZEST restores this loss. ZEST is effective in tiny amounts either before, during or after processing. After using ZEST, food processors instantly notice a marked flavor improvement. Write today for all the details about the seasoning that makes foods sell better!

Zest®

PRODUCTS FROM CORN
Staley's

Staley's 99+% Pure Monosodium Glutamate

A. E. Staley Manufacturing Co., Decatur, Illinois

Mail this coupon for the complete ZEST story.

A. E. Staley Mfg. Co.
Dpt. FE-10, Decatur, Illinois

Gentlemen: Send me all the facts about ZEST—the amazing seasoning that boosts natural food flavors.

*Name*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

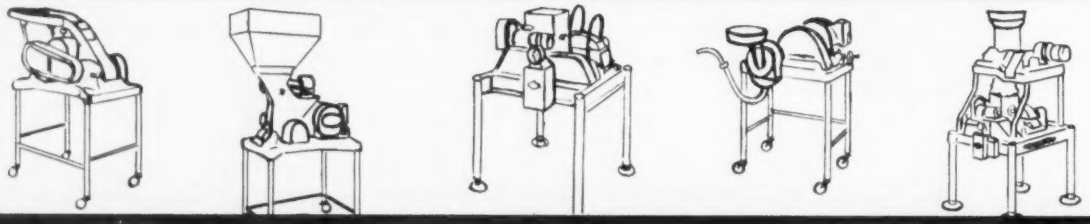
For more information, use coupon on page 207.

FOR COMMINUTION OF

CREAM CHEESE
SHREDDED CODFISH
BARBEQUE RELISH
BABY FOODS
MARMALADE
NUT GRANULATIONS
TEA-LEAF CUTTING
TEA-BAG RECOVERY
RICE GRANULATION
CEREAL LUMP RECOVERY
PEANUT BUTTER — COCOA NIBS
SUGAR — SPICES — PINEAPPLE
WHOLE ORANGES — WHOLE APPLES
BANANAS — GRATED CHEESE
MAYONNAISE — FROZEN EGGS
SOLUBLE COFFEE — CATSUP
GREEN BONES — PUMPKIN
PUREE MEAT
CREAM STYLE CORN
CHICKEN SKINS
VANILLA BEANS
ALMOND PASTE
CHEESE SPREADS
POTTED MEATS
DEVILLED MEATS
PEA SOUP
WHOLE DRIED MILK
SUGAR WAFER RECOVERY
SAUSAGE EMULSION
CHICKEN NECKS & BACKS
MACARONI SCRAP
FISH PASTE
BREAD CRUMBS
CRACKER CRUMBS
MUSHROOMS SOUP STOCKS
FIG PASTE CHIVES
FRESH & FROZEN FRUITS
MATZO MEAL

LET A FITZMILL ENGINEER ASSIST YOU IN YOUR PROCESSING OPERATIONS

Do It The FITZWAY



THERE ARE HUNDREDS OF FITZMILLS TO MEET EACH COMMINUTING REQUIREMENT

FITZMILL TRADE MARK

THE W. J. FITZPATRICK COMPANY

1001 WEST WASHINGTON BOULEVARD
CHICAGO 7, ILLINOIS

Field Offices: NEW YORK • BOSTON • PHILADELPHIA • SPRINGFIELD • SAN JOSE • TORONTO
MONTREAL • COPENHAGEN • MILAN • CAPETOWN

For more information, use coupon on page 207.

The Vacuum Seal with Sales Appeal!

This is the cap that has everything housewives want. It's the answer to their hope for a better, handier vacuum seal closure.

It goes without saying that the Crown Vacuum Lug Cap gives dependable sealing. That's the number one requirement . . . but look at the other customer winning features this cap offers:

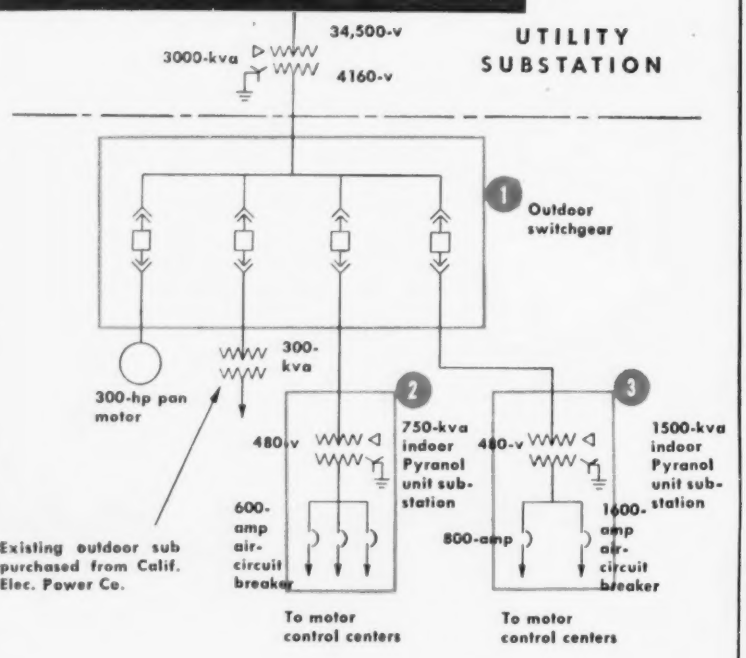
We want an opportunity to tell you more about this wonderful cap and the machine that applies it automatically at high speed . . . the Cem Vacuum Lug Capper. A phone call or letter will bring complete information.

CROWN *Vacuum Lug Caps*

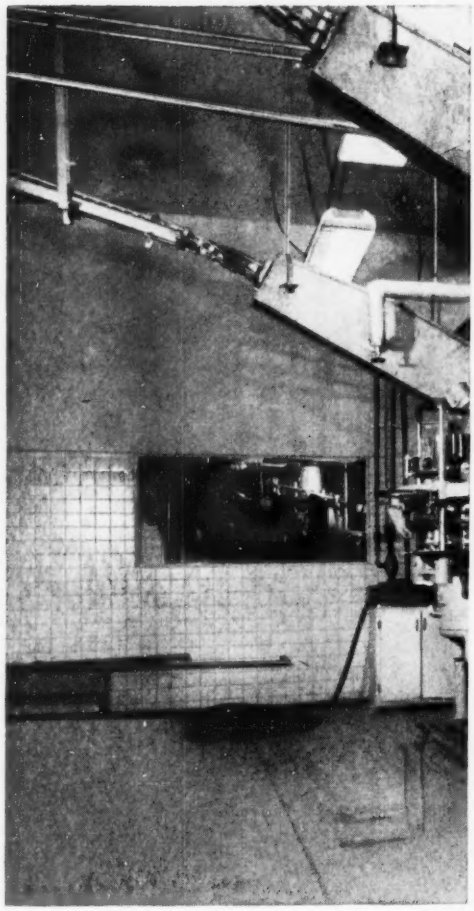
CROWN CORK & SEAL COMPANY *Closure Division • Baltimore 3, Maryland*

For more information, use coupon on page 207.

ENGINEERING REPORTS:

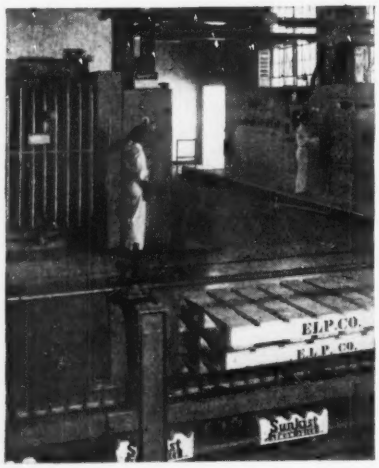


4160- and 480-volt systems neutral grounded to limit possible overvoltages from ground faults

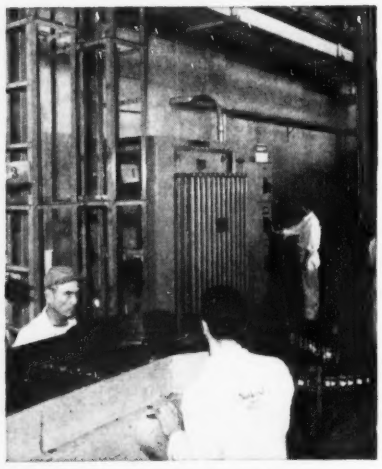


Planned power system makes it easy

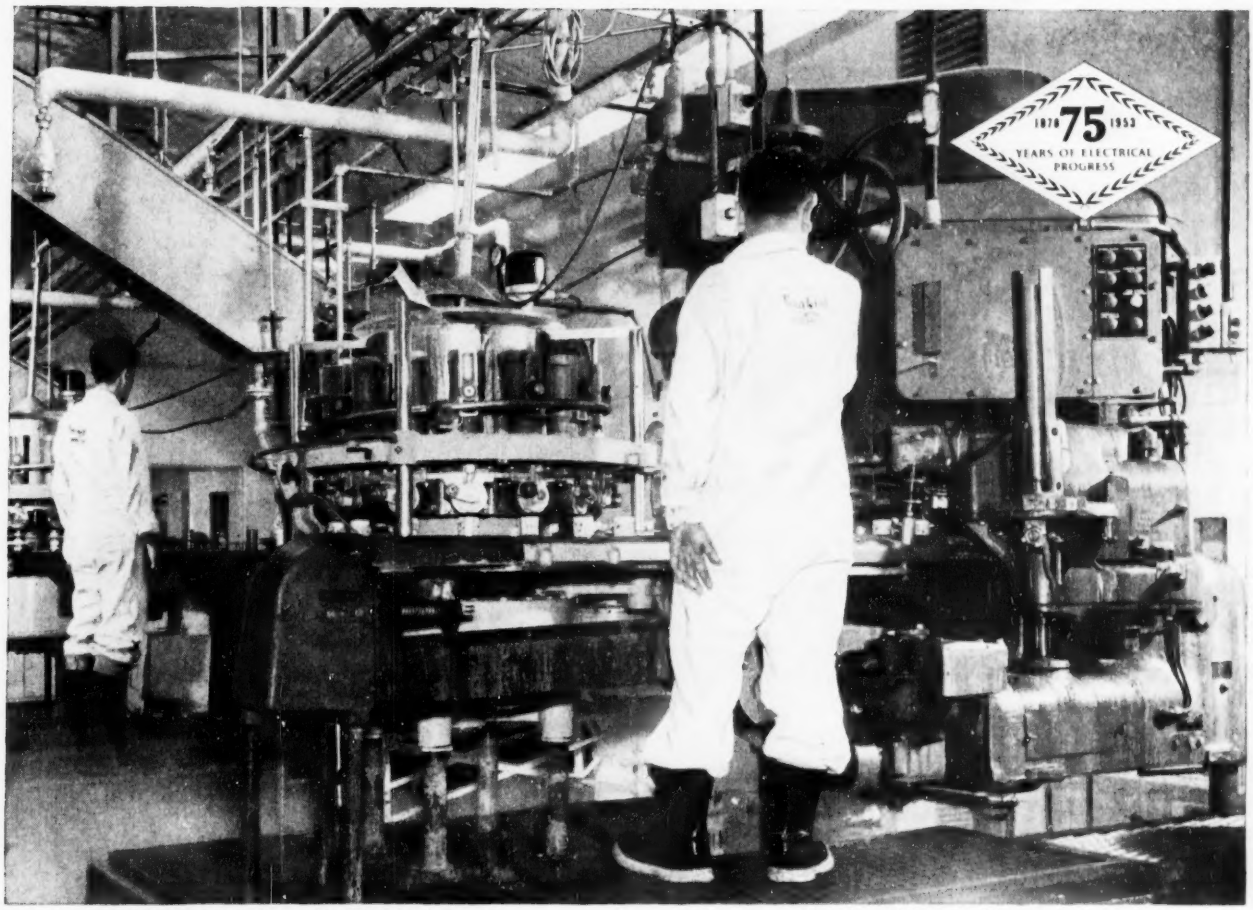
1 Compact, accessible G-E metal clad switch gear distributes high-voltage power to plant. Result: no voltage drop problems, major power savings.



2 750-kva "Building Block" G-E unit substation (background) was easy to install. It was delivered factory-assembled and tested, ready to be set in place.



3 1500-kva unit substation, located near processing line, shortens costly low voltage branch circuits. Drawout circuit breakers simplify maintenance.



BETTER PRODUCTION CONTINUITY for these two sealing machines at Exchange Lemon Products results from the full voltage delivered by one of the G-E unit substations. Full voltage at utilization points provides adequate motor starting torque, normal loading without excessive currents, and full illumination for plant lighting.

for juice extraction plant to expand

Exchange Lemon Products Co. lowers expansion costs with G-E radial power distribution system

Thanks to *system planning*, Exchange Lemon Products Company's juice plant at Corona, Calif., can expand steadily and not outgrow its basic electrical system.

At present, this growing affiliate of Sunkist is processing more than 1500 tons of lemons each day. To handle the heavy electrical loads that have developed, Exchange engineers and General Electric Food Industry specialists worked out a co-ordinated low-cost radial distribution system built around G-E load center unit substations. To keep up with future expansion at minimum expense, additional unit substations can be added like building blocks. This has kept investment low by avoiding purchase of unnecessary transformer capacity.

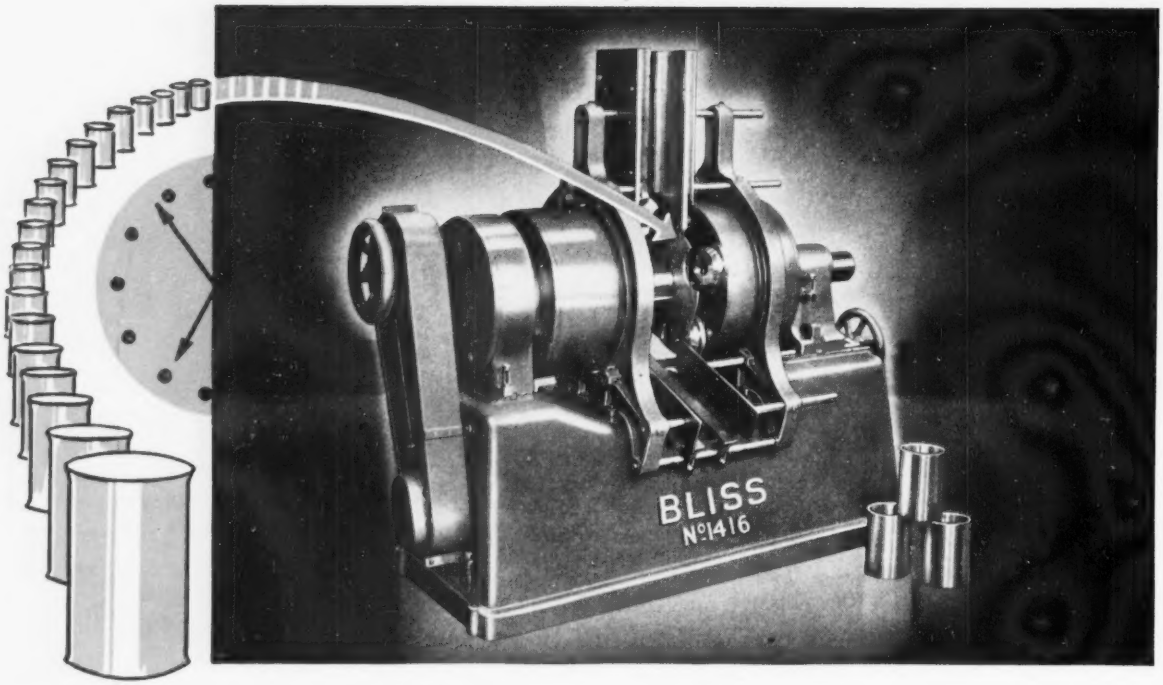
Strategically located throughout the plant, these G-E unit substations play a key part in keeping the length of costly low voltage feeders to a minimum and reducing the short circuit interrupting duty on feeder breakers while delivering full voltage all along the line. High voltage lines that supply the substations can be extended as the plant grows to tie in additional load centers. The need to run individual feeders all the way back to incoming power can be avoided.

If power loads in your plant are increasing, you probably stand to profit by planning a new power system. Talk it over with your G-E Apparatus Sales Representative—find out how step-by-step modernization with G-E load center substations can spread out costs, prevent production interference. General Electric Company, Schenectady 5, New York. 652-14

Engineered Electrical Systems for Food Plants

GENERAL ELECTRIC

For more information, use coupon on page 207.



Hour in and hour out . . .

DEPENDABLE BLISS round can flangers produce perfect double end flanges at high speeds

Which of these two flangers best suits your needs?

- *The 1315 Flanger with eight stations flanges cans from 2" to 4-3/16" diameter; from 2" to 8" high.*
- *The 1416 Flanger (illustrated) has four stations, and flanges No. 10 and similar-sized cans.*

Both models are fast and fully automatic. But, more important, both are engineered to give *long, trouble-free* performance. Flanging slides are closely spaced to allow small diameter turrets (note photograph) which work at high speeds with very little wear. All models are housed in a heavy Meehanite cast base.

To learn more about these dependable Bliss Flangers—and other equipment in the Bliss can making line—write or wire today for Catalog 36-A.

E. W. BLISS COMPANY
50 Church Street
New York 7, New York

BLISS on your machine is more than a name... *it's a guarantee*

BLISS CAN AND CONTAINER MAKING MACHINERY

SLITTERS

BODYMAKERS

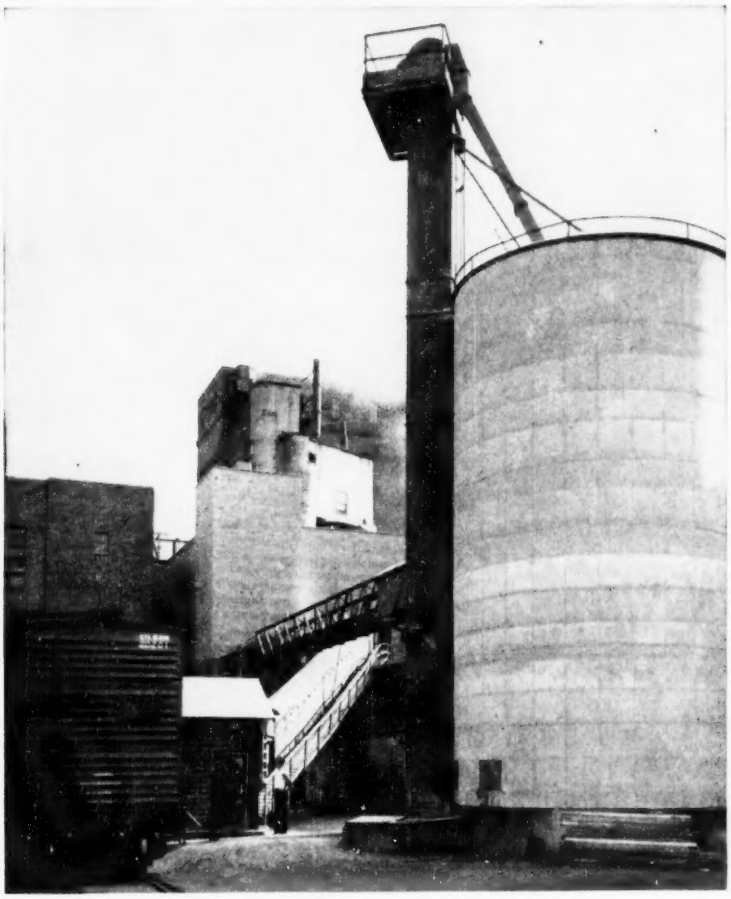
FLANGERS

SEAMERS

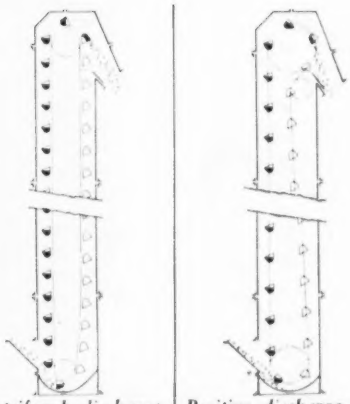
TESTERS

STRIP FEED PRESSES

13 types...4 basic designs
to meet your elevating requirements

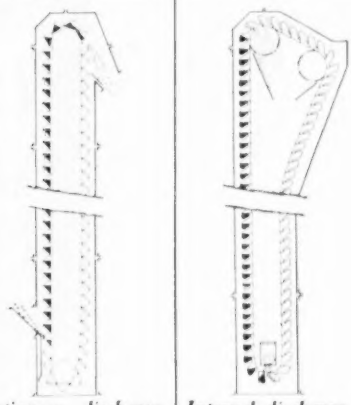


Link-Belt screw conveyor and bucket elevator handle material from railroad car to storage silo.



Centrifugal discharge for free-flowing, fine or loose materials with small to medium lumps.

Positive discharge for light, fluffy, fragile or any materials that tend to stick to the buckets.



Continuous discharge for many materials—light to heavy, small to large, abrasive lumps.

Internal discharge for gentle handling of small articles such as pellets, rivets, seeds, castings.

Let LINK-BELT recommend the bucket elevator best-suited to your needs

WHERE large or small quantities of bulk materials must be elevated in limited space, a bucket elevator is the equipment you need in most cases. And, in every case, you'll find the one that can do the job for less in the complete Link-Belt line.

Link-Belt builds a type and size of bucket elevator for every requirement. Included in the 4 basic designs are 13 types of bucket elevators designed to suit a variety of materials. A wide range of sizes on chain or belts is also available.

Other Link-Belt engineering extras: Rigid, jig-built casings are self-supporting requiring only occasional lateral tie-ins depending on height. Periodic inspection is speeded with easy access to both head and boot. Chain or belt tension is maintained at all times with simple screw or gravity take-ups. You can get complete engineering information from the Link-Belt office near you.

LINK-BELT

BUCKET ELEVATORS

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities. 19.213-A

For more information, use coupon on page 207.

Rx: to relieve Quality Control "headaches"... BLEND MATERIALS IN SIMPSON MIX-MULLERS!

MULLING GIVES YOU POSITIVE CONTROLLED RESULTS

Watch the practiced technique of a chemist's mortar and pestle—the intensive rubbing and smearing actions—and basically, THAT'S MULLING!

Mulling with a SIMPSON Mix-Muller utilizes a special pair of revolving mullers and plows mounted on a stationary pan. The mullers are adjustable and are supported by rocker arms. This leaves them free to ride on the material, creating a true mulling action as they revolve. The results are thorough, more rapid blending.

IF you are having quality control "headaches," it will pay you to take a good close look at your *mixing* operations. Experience has shown that improperly mixed materials can often be the cause of inferior end-products or processes.

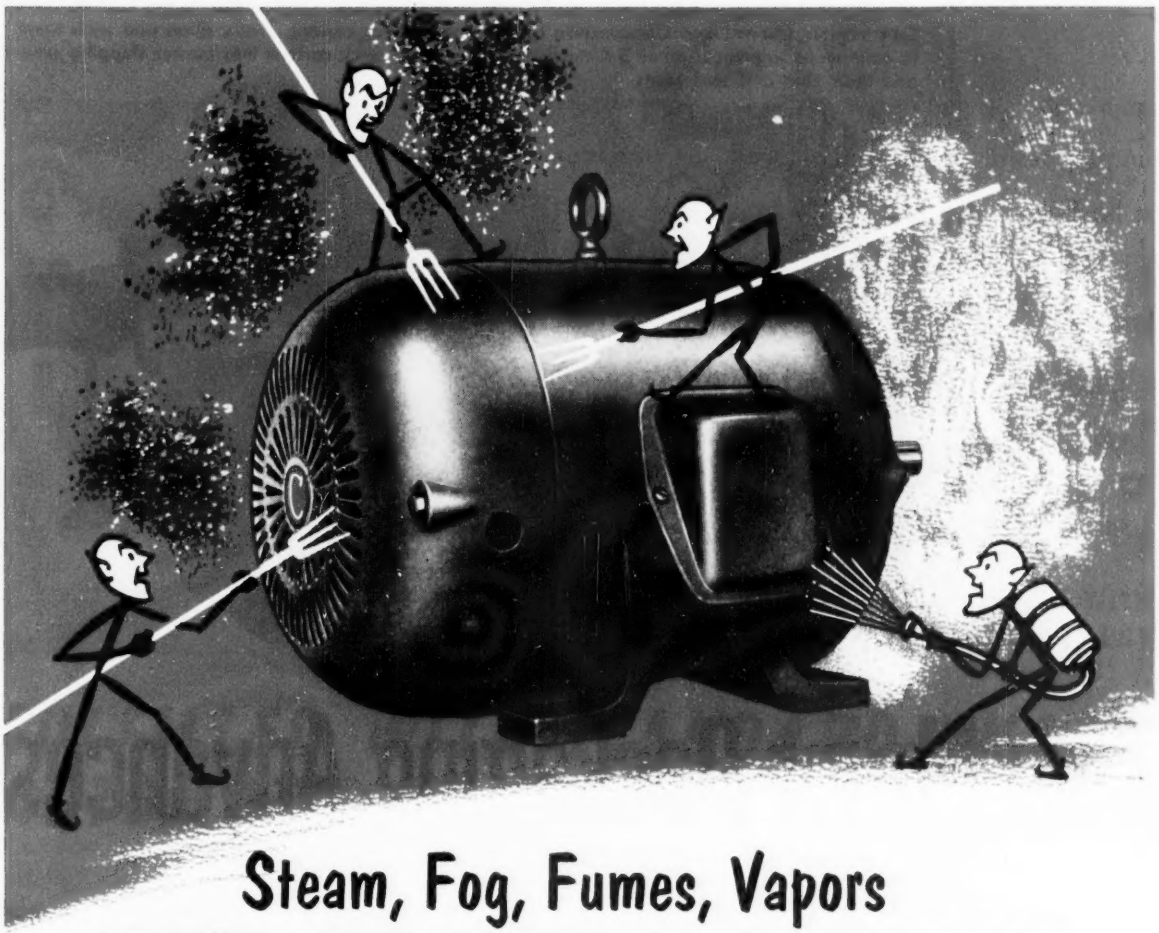
The type of mixing equipment you use is, of course, the secret to properly controlled mixing. When you use Simpson Mix-Mullers, you are assured of complete control at all stages of mixing . . . with uniformly blended batches that will be the same—day in, day out—as proved by hundreds of successful applications throughout the chemical process, food and ceramic industries.

Built in twelve basic models, in capacities from 1/10 to 60 cu. ft., Simpson Mix-Mullers all give you the time-tested mulling principle of controlled mixing, with emphasis on improved quality at lower mixing cost.

Let a National Engineer show you how these versatile Mix-Mullers can help solve your particular mixing problems. Write for details.

SIMPSON *MIX-MULLER*® DIVISION

NATIONAL ENGINEERING CO., 622 Machinery Hall Bldg., Chicago 6, Ill.
(Not Inc.)



Steam, Fog, Fumes, Vapors
CAN'T GET UNDER THE "SKIN"

of your Century

TOTALLY
ENCLOSED
FAN
COOLED MOTORS

The inner frame of your Century TEFC Motor completely seals all the vital working parts against air-borne hazards. An effective stream of air blown between the inner and outer frames, keeps the motor temperature within safe limits at rated load.

Century TEFC motors operate your equipment efficiently in any kind of atmosphere — resist dusts, dirt, chemical or oil fog, and mists.

Whatever the job or working conditions, Century's wide line of types, sizes, and variety of operating characteristics, enables you to select the motor specifications for top equipment performance.

⅛ to 400 horsepower ratings — A.C. or D.C.— Furnished in Drip Proof — Splash Proof — Dust Proof — or Explosion Proof frames — for most all atmospheric surroundings.

Specify Century motors on your new equipment or replacements. Your nearby Century District Sales Office or Century Distributor will be glad to give you full information.

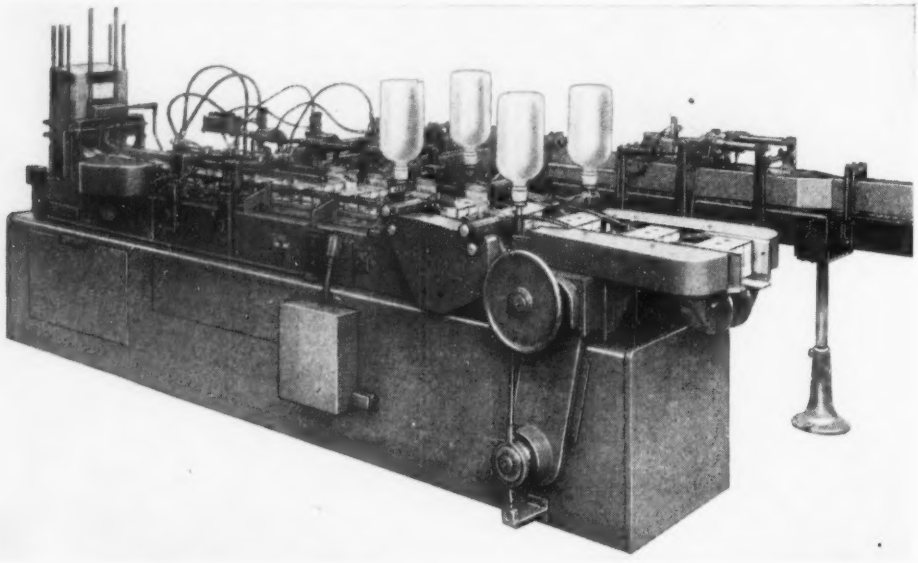
Century C MOTORS

CE-779

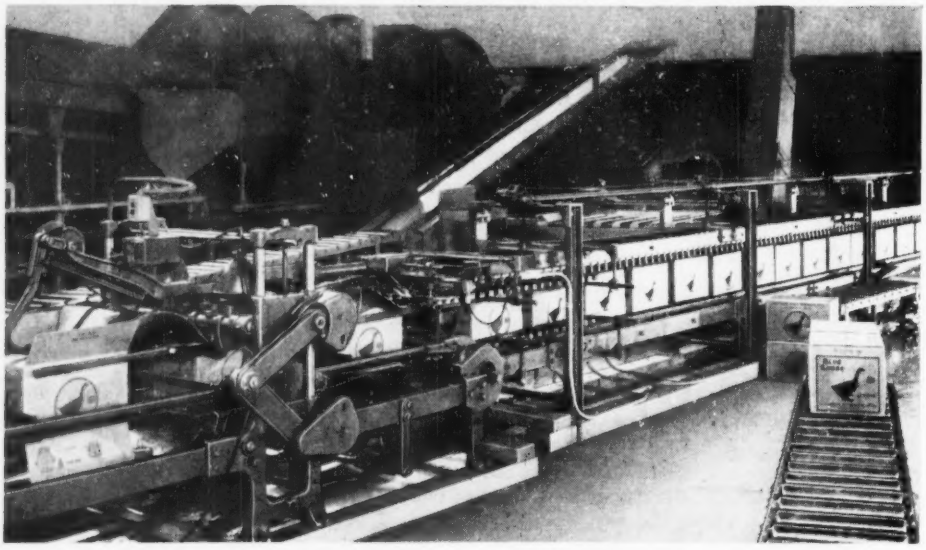
CENTURY ELECTRIC COMPANY • 1806 Pine Street, St. Louis 3, Missouri
Offices and Stock Points in Principal Cities

For more information, use coupon on page 207.

500-CAN-PER-MINUTE LINE FOR PACKAGED BEER Equipment developed by Standard-Knapp is helping brewers set new records for speed and efficiency in packaging canned beer. Can Inserter (shown) and Compression Unit opens six-pack cartons, loads, glues and seals them. In continuous sequence, other S-K machines collect and pack cartons into master shipping cases and then glue and seal cases.



Two Major Packaging Advances



IMPROVED CITRUS FRUIT PACKAGING Economies resulting from the use of corrugated shipping cases for citrus fruits are realized through the use of Standard-Knapp Gluers and Sealers. Citrus packers relied upon Standard-Knapp's application engineering to supply adequate equipment.

Only the best is good enough

Here you have two instances where Standard-Knapp equipment and application engineering solved important packaging problems. In the brewing industry, the need was for higher speeds effective throughout a complete line. In the citrus industry, the need was for equipment to prepare the new type shipping case for transportation and marketing.

Standard-Knapp has the breadth of experience to help you determine how and where to boost output, modernize or re-equip — the kind of experience that does not sell you a machine but an end result that pays off in lowered costs, increased productivity, reduced maintenance. As proven in the brewing, citrus and other industries,

IT PAYS TO STANDARDIZE WITH STANDARD-KNAPP EQUIPMENT

FULFILLED WITH STANDARD-KNAPP AUTOMATIC PACKAGING EQUIPMENT

IT'S EASY TO BRING YOUR INFORMATION FILE ON STANDARD-KNAPP UP-TO-DATE BY USING THIS COUPON

DEPT. F
STANDARD-KNAPP *DIVISION OF EMHART MFG. CO.*
PORTLAND, CONNECTICUT

Please send me information on equipment checked below:

- ☐ Bottle Packers
- ☐ Labelers
- ☐ Can Packers
- ☐ Gluers and Sealers
- ☐ Rinsers
- ☐ Six Can Cartoners
- ☐ Can Palletizers & De-Palletizers

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

STANDARD-KNAPP *DIVISION OF EMHART MFG. CO.* **PORTLAND, CONNECTICUT**

For more information, use coupon on page 207.

a dependable preservative from a reliable source . . .

for preserving the flavor and quality of food, beverages, syrups, concentrates . . . safely and economically

Heyden
SODIUM BENZOATE

Other Heyden products important in flavoring and preserving . . .

BENZOIC ACID
BENZALDEHYDE
METHYL SALICYLATE
PROPYL GALLATE
SACCHARIN
SACCHARIN SODIUM

HEYDEN CHEMICAL CORPORATION
342 Madison Avenue, New York 17, N. Y.
CHICAGO • PHILADELPHIA • SAN FRANCISCO • DETROIT • PROVIDENCE

FINE HEYDEN CHEMICALS

Benzaldehyde • Benzoates • Benzyl Chloride • Chlorinated Aromatics • Creosotes • Formaldehyde • Formic Acid
Glycerophosphates • Guaiacols • Hexamethylenetetramine • Medicinal Colloids • Methylene Disalicylic Acid • Neomycin • Paraformaldehyde
Parahydroxybenzoates • Penicillin • Pentaerythritols • Propyl Gallate • Resorcinol • Salicylates • Salicylic Acid • Streptomycin

SYLPHON HOT-COLD WATER MIXER
NO. 902

Sylphon Mixer blends hot-cold water to constant temperature —saves waste and "worries"

WHEREVER constantly tempered water is needed—for processing, wash basins, showers or other industrial uses—this Sylphon Hot-Cold Water Mixer can be a real help.

It works simply and effectively. Using hot water from any storage tank or instantaneous heater, it blends in cold water in the amount required to temper the hot water to the desired degree. Water is mixed together before delivery. Gives you accurately controlled, constant temperature supply. No waste.

More advantages! If the supply water temperature or pressure fluctuates, temperature remains constant. If either hot or cold water supply fails, this Sylphon Mixer automatically shuts off the remaining supply. When supply returns, flow starts up. Extra safety!

Sylphon Hot-Cold Water Mixers are self-contained, self-powered. Adjustable temperature range. Installation is simple. Sizes for various capacities and supply pressures. Built to serve economically for years. For complete information, write Department TG-D.

Robertshaw-Fulton
CONTROLS COMPANY

FULTON SYLPHON DIVISION
Temperature Controls · Bellows Devices · Bellows Assemblies
KNOXVILLE 1, TENN.

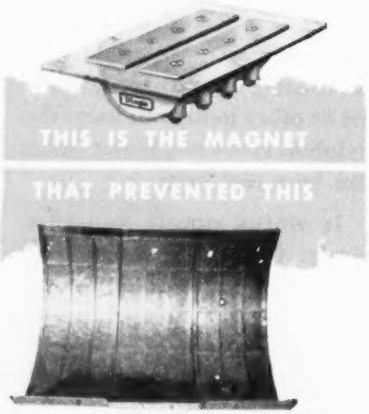
For more information, use coupon on page 207.

Once upon a time a Milwaukee spice processor got fed up with replacing $18.00 screens ruined by tramp iron hurled through them by a spice mill.

So he called his Dings Magnets representative, who advised him to put a Dings Perma-Plate Magnet at the base of the hopper that fed the mill.

This powerful, non-electric Alnico magnet traps and holds tramp iron in its field until the mill is cleaned at the end of an operating cycle.

This is the way Dings Magnets can help processors of all kinds to protect equipment, produce a more pure product. *Write for free Catalog C-5000-B.*



It's a powerful, non-electric Dings Perma-Plate. Perma-Plates are available in a complete range of sizes and three strengths. They're easily installed in chutes, ducts, over belts and elsewhere. They require no maintenance, have certified strength that's guaranteed forever.

Dings

DINGS MAGNETIC SEPARATOR CO.
4741 W. Electric Ave. • Milwaukee 46, Wisconsin

Magnetic Separation Leader for over Fifty Years

PP-883

New INTERNATIONAL R-190 Series. GVW ratings, 21,000 to 24,000 lbs. Choice of gasoline, LPG, or diesel power.

They can put jam on your bread too!

This big INTERNATIONAL ROADLINER® is hauling enough jam to spread 750,000 slices of bread. It's one of a fleet that spreads jams, jellies, and preserves over 48 states, at a rate of 300,000 cases monthly, for a leading processor.

INTERNATIONAL ROADLINERS can put jam on your bread too with savings on hauling costs.

For, like every model in America's most complete truck line, INTERNATIONAL ROADLINERS are *specialized* for the job.

That means specialized *power*. The big-truck power that the new INTERNATIONAL valve-in-head engines deliver at amazingly low cost.

It means specialized *chassis*, with the built-in stamina that has made INTERNATIONAL the heavy-duty sales leader for 21 straight years. The stamina that pays off in lower maintenance costs and long life.

And it means specialized *cabs*. The famous Comfo-Vision regular or sleeper cabs that boost driver efficiency through unsurpassed safety, comfort, and convenience.

Get complete details from your INTERNATIONAL Dealer or Branch. Time payments arranged.

AMERICA'S MOST COMPLETE TRUCK LINE

170 basic models from ½-ton pickups to 90,000 lbs. GVW off-highway models . . . line includes 23 six-wheel and four 4 x 4 models . . . conventional or cab-forward types . . . 307 new features in the new R-line . . . 29 engines from 100 to 356 hp., with widest practical choice of gasoline, LPG, or diesel power . . . 300 wheelbases . . . transmissions and axle ratios for any need . . . wide selection of bodies and equipment . . . thousands of variations for exact job specialization.

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For fine throttling control and proportional flow... for greatest efficiency, lowest operating costs — install strong, dependable Hancock "Flocontrol" Valves in your lines. Your nearby Hancock Distributor will gladly give you full details.

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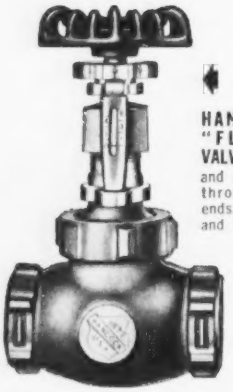
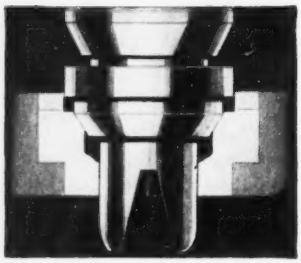
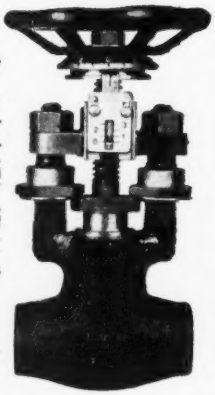


HANCOCK BRONZE "FLOCONTROL" VALVES. **Types:** Globe and Angle. **Sizes:** ¼" through 2". Screwed ends. Available in 150# and 300# Series.





HANCOCK 600# STEEL "FLOCONTROL" WELDVALVES. **Types:** Globe and Angle. Outside Screw and Yoke. **Sizes:** ¼" through 4". Screwed, Socket Welding and Flanged Ends. Available with 150#, 300# and 600# Series Flanges.

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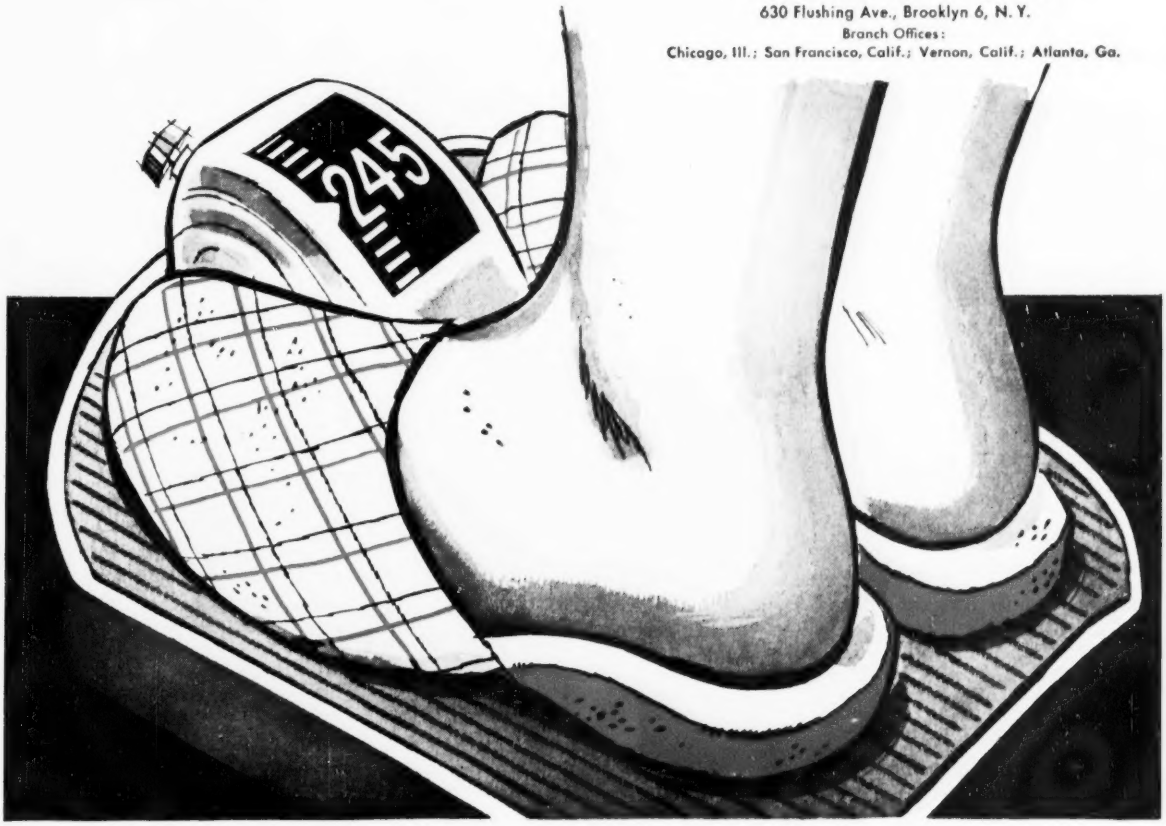

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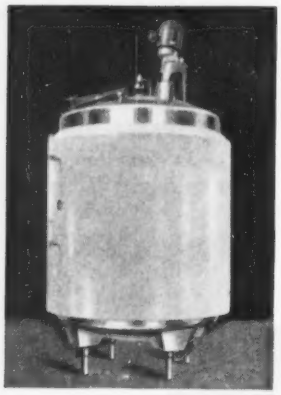

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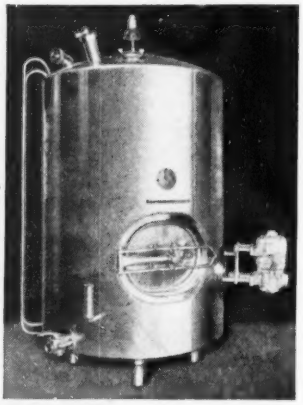

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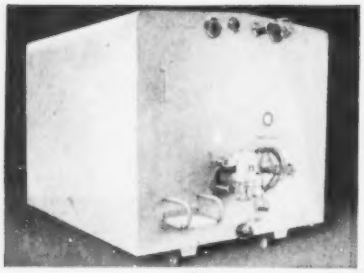

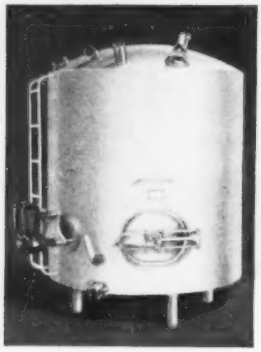

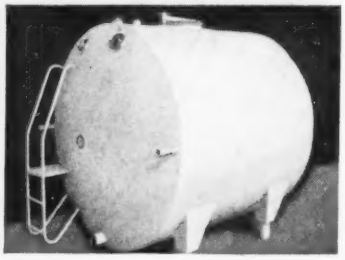

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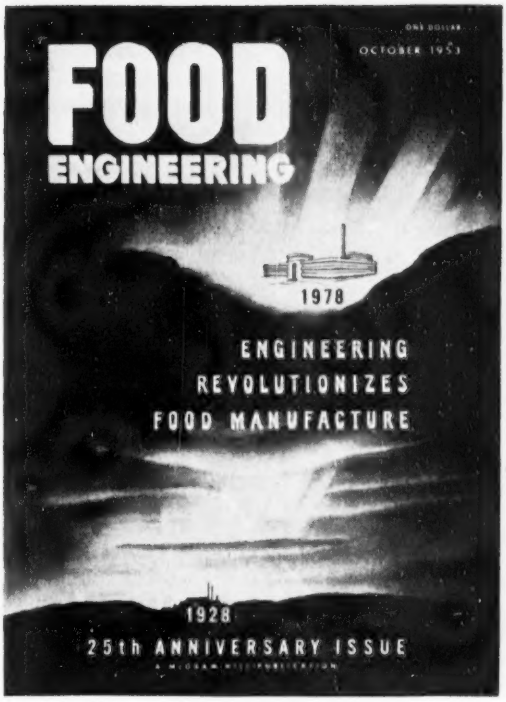
REPORT ON A REVOLUTION



FOOD MANUFACTURING is passing through an engineering revolution. It is developing into a big-time technical industry. Why, how, and how fast are questions vital to every company and every person in the food and allied industries.

So we have taken the occasion of the 25th Anniversary of FOOD ENGINEERING to give you the answers—in economic and technical detail.

We trace trends and report new developments from 1928—when our publication was founded—to the present. Then we look into the future toward 1978.

We point up the salient features of the food plant of tomorrow, then we fill in the details with articles on all basic unit operations involved in food manufacturing—plus a couple coming in the future.

Not only the nature of advances, but the benefits therefrom are presented. This issue, then, will tell you where you and your plant stand in the parade of progress—in efficiency compared to the pace-setters. More, it will tell you how you can improve your position today and what to include in your planning for tomorrow.

No food publication ever before attempted a project so comprehensive or so fundamentally important to people in the industry. This issue climaxes a quarter century of technical service to the food field. We celebrate by giving you a tremendous bundle of useful information—rather than by filling pages with the general history of the industry and of our publication.

Fewer Plants to Feed 231 Million

Here's why this issue is so timely and important.

Our industry will be feeding 231 million people in 1978. But fewer plants, by far, will be doing the job than now feed the present 160 million population.

And unless advanced food-plant engineering forms the basis of your future plans, your plant or firm will not be among those present 25 years from now.

Fewer plants will be doing the job in '78 because they will be equipped with high-capacity, low-unit-cost, continuous processes. They will have advanced quality control techniques which bring the control lab to the production line and integrate it with mass-production through new in-stream analytical instruments. And they will be automated with integrated control systems.

Yes, the smallest plant in the future will be one large enough to take advantage of highly efficient methods.

All this is but a continuation of an already existing movement. A sharp trend to bigger, better, and fewer plants is revealed in the economics section of this issue. Portrayed, too, are basic associated trends—such as the rise in capital investment per worker and the higher productivity thereby achieved.

Technical Advances Underlie Trend

The significant engineering advances underlying these vital economics-of-progress trends are highlighted in a series of articles on unit operations in this issue. Even a glance at the engineering tidal-wave charts in these articles will tip you off to the extent and rate of improvement.

Starting with the status of the unit operations in 1928, these articles take you through outstanding improvements of the past quarter of a century—most of which have occurred in the last decade. Then the articles take a look ahead to help you in planning for the future.

Weigh Ticket on Scales of Progress

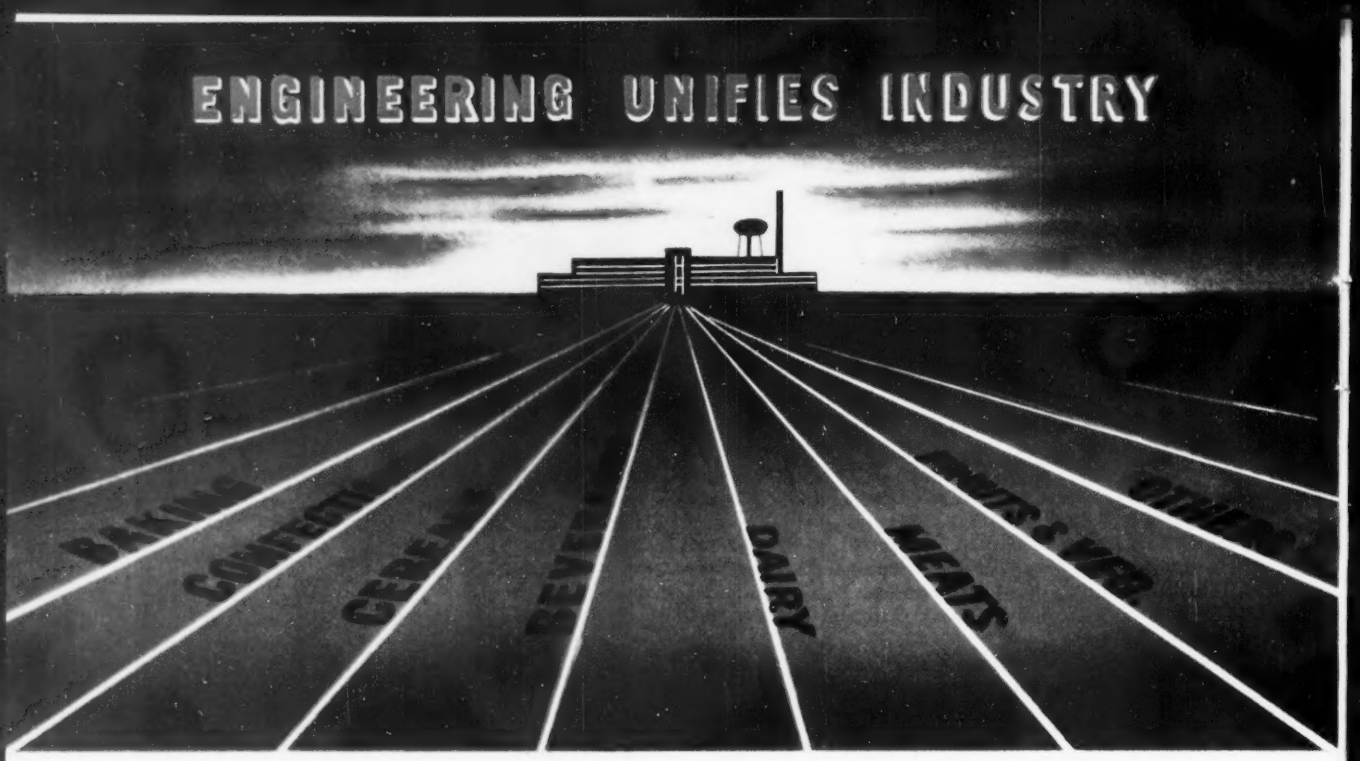
In a very real sense, this issue of FOOD ENGINEERING constitutes your weight ticket on the scales of progress. And more, it tells you what it takes to correct a short situation before it is too late: What kind of plant performance is required. What types of equipment will give you that performance. And what magnitude of capital investment is needed to keep up with competition.

Preparation of this issue has been a large order. But we shall be well repaid if it serves its purpose. And we hope you will peruse it from cover to cover—for only then can you get the full import of the trend of events.

Acknowledgment

Twenty of the articles were staff written, and we wish to acknowledge the invaluable aid of people and companies in the food and allied industries who cooperated with our editors to make the issue possible. We also thank the five outside experts who prepared articles especially for the issue at the request of the editors.

PS—Your comments and criticisms of this issue will be welcome. We particularly would like letters giving your viewpoints on the trends and problems ahead.



ALL CONVERGE INTO ONE

ONE OF THE MOST SIGNIFICANT results of the engineering revolution in food manufacture is this: The branches of the industry have come together into one industry, with common technical and engineering problems. Food manufacturing no longer is a collection of several industries, as it was before 1928. Today it is one industry.

Twenty-five or 30 years ago, the various branches of the industry did not admit of much in common—other than the fact that they produced products which were competitive, or were sold to other branches. But since then, and particularly within the past decade, each branch of the industry has borrowed ideas, methods, and equipment from others at a great rate. The results are (1) a sameness among unit operations and techniques, (2) a similarity in plant and equipment design and construction, and (3) homogeneity in functions such as sanitation and quality control.

The Food, Drug & Cosmetic Act of 1938, assisted by the multitude of standards and regulations that followed, also has brought the divisions of the field together. These controls have created common problems in respect to ingredients, processing methods, sanitation, quality control, and packaging.

Witnesses to the Marriage

One important witness to the marriage of branches is the formation and rapid growth of the Institute of Food Technologists. Established 14 years ago, this one-industry association has gained large membership from technical men in all types of food manufacturing operations.

But even more specific and pointed evidence of the one-industry trend is found in the unit operations. You will see this as you read the articles in this issue and as you look at the engineering tidal-wave charts—see it clearly.

You will note how advanced heat-transfer methods originating in one branch have spread through many others. And the same for proportioning, mixing, disintegrating, forming, and packaging, to name only a few.

The engineering development trend has been sharply toward operations and equipment that solve food manufacturing and packaging problems on a broad scale, not just in one type of plant.

This trend is going to continue, and at an accelerated rate. Why? Because the equipment manufacturer can afford to put much more research, development, manufacturing expense, and performance into a machine that is bought by many branches of the industry.

It is only natural that the industry should become one. The surprising thing is that it went pretty much through the first quarter of this engineering century in the form of divisions which saw little in common among them.

Mediums for Exchange of Know-How

As the industry well knows now, the old isolationist viewpoint was a sad, progress-retarding mistake. But perhaps the industry was not to blame. There existed no medium for effective exchange of information between branches, a necessary prelude to "unification."

The launching of *Food Industries* by McGraw-Hill Publishing Co. in October, 1928 created for the first time a medium for the exchange of ideas and information about advanced methods, equipment, ingredients, materials, and technology. By publishing information of common value to people directing and supervising operations in food plants, this publication fostered the industry's unification and progress. At the same time it provided editorial leadership and guidance.

As the industry profited by interchange of know-how, an upsurge in food engineering began to take shape. So

in April, 1951, FI was converted to FOOD ENGINEERING to even more effectively serve the needs of the industry in its switch to continuous, automatic processes.

About a decade after the founding of "Food Industries," the Institute of Food Technologists was conceived. Far-seeing technical men in the industry, including editors of this magazine, saw the need for a technical society embracing all divisions of the industry and dedicated to the solution of their common problems, in behalf of progress, through interchange of information.

Operations Basically the Same

By the very nature of their operations, the various parts of the food industry are on common ground. They all take edible, more or less perishable, materials and prepare them for human consumption. They either preserve these materials, convert them to a more desirable form, or combine them to manufacture tasty and nutritious foods that are not produced by Nature.

In any event, they have to determine raw material quality, take materials apart, put materials and ingredients together, form them, treat them with heat or refrigeration, let them undergo chemical or biologic change under controlled conditions, and put the finished products in technically proper packages.

And all the while they are moving the materials and ingredients from point to point in plant and process, are maintaining a sanitary environment, and are determining and checking quality characteristics and controlling temperature, time, pressure, pH, and other variable factors.

So what is a bakery for instance? It is a food factory which derives its distinguishing name merely from the fact that its heat transfer operation involves a bake-oven. But some frozen food plants use a similar "belt in a box" heat transfer unit, only it employs low instead of high temperature.

A quarter of a century ago, a continuous heat exchanger --or freezer--revolutionized ice cream manufacture. Now we find this heat exchanger in the short-time high-temperature canning process. And here tandem units do two jobs. One heats the product to sterilize it, and the other cools the product to canning temperature. And this same heat exchanger is used in processing a host of viscous food products in many branches of the industry.

And take the operation of proportioning ingredients in product formulation. It makes no difference to the machine whether it is handling dry ingredients in a flour mill, a bakery, or a dessert-mix plant.

Then there is the continuous mixer that works just as well on mayonnaise as on marshmallow or cake batter. The comminutor which finely chops any kind of food you care to put into it. The conveyors that handle any kind of dry products in any food plant, and others that move fluid and semi-fluid products without discrimination. And to temperature, pressure, and pH controllers, the type of product doesn't matter. Liquid fillers handle any liquid food, similarly for viscuous and dry product fillers. As for cartoning and wrapping machines, they should worry about what is in the package.

You see what we mean about those common operations.

And even more obvious is the inter-branch sameness of such functions as sanitation and quality control, and such services as air conditioning, lighting, water supply, power transmission, fire protection, lubrication, building construction, piping, and accessories.

Yes, food manufacturing has become one industry. It has tossed its problems into a common pool, with all branches teaming up to find better solutions. Since several heads are better than one, the result is much faster progress. And as made sharply obvious in the economic section of this issue, such progress is essential not merely to profit but even to staying in business.

FOOD INDUSTRIES

manufacturing and processing

October, 1928

A POLICY AND A PURPOSE

FOOD manufacturers have a common interest in satisfying human hunger and thirst. But in their manufacturing operations they have another community of interest which, while not so apparent, has a direct bearing on methods of production. It lies in the fact that the same processes based on the same fundamental principles are applied in making a variety of food products.

PLAYS MAJOR ROLE—Founded 25 years ago, "Food Industries" was first medium for exchange of information between branches. Changed to FOOD ENGINEERING in April, 1951, magazine now serves industry even more effectively.

Tidal Wave of Progress

SYMBOLIC—Technical upsurge in food manufacturing has taken on the proportions of an engineering tidal wave. So each unit-operation article in this issue will have a "points of progress" chart on a tidal-wave background. These charts also reveal the extent to which advances originated in one branch have spread through others to unify the industry.

Trend to Multi-Product Firms

On top of the inter-branch exchange of information, the industry is becoming one in another way. We refer to the trend to multi-product operations in food plants to provide more uniform year-'round operation and to broaden the product-sales base. Many leading firms in the industry have become in name, as well as in fact, "Food Products" companies—not just dairy products manufacturers, meat packers, or what have you.

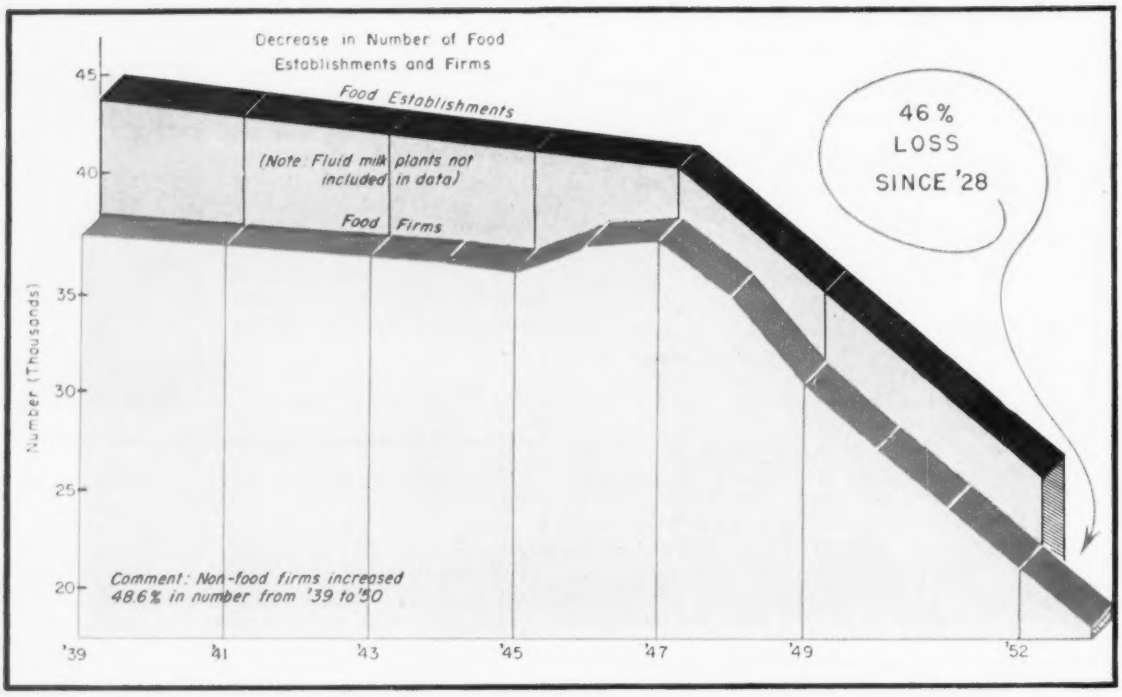
Many leaders in the industry see this trend as a prerequisite to a sounder business, just as is the move to larger, more efficient plants.

1978's Common Identity

So the industry has become one. And by 1978 it will have adopted common operations and gone multi-product to such an extent that in many instances it will be difficult to tell one type of plant from another.

By that time food engineering will have remolded the basic elements of food manufacture so completely as to give them its stamp of common identity.

Sharp drop since 1947 in food plants and companies, and a 46% loss in firms since 1928.



Food Plants Fewer in Number

ECONOMICS OF TECHNICAL PROGRESS

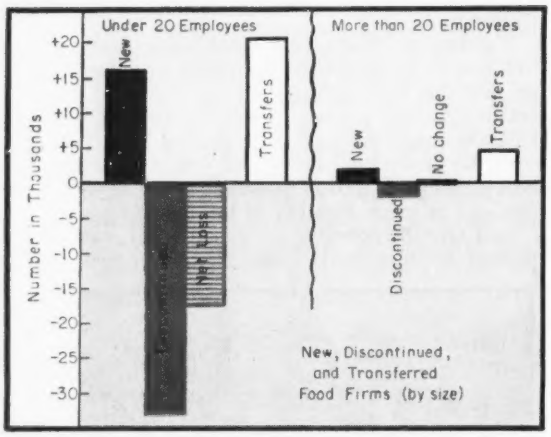
DURING THE LAST 25 YEARS, unincorporated food concerns dwindled while the corporations increased. Particularly rapid in the last decade, this shift is one of the basic trends in food manufacturing.

Between 1929 and 1952, the food industry lost 50% of its proprietors. By contrast, other manufacturing gained 45.5%.

The ratio of corporation-owned plants to the total food plants increased from 39.5% in '39 to 48.7% in '47. Proportion of corporate-owned plants of other manufacturers decreased from 56.2% to 49.1% during the period.

Although this trend has continued since '47, the remaining independent food organizations accounted for 13.4% of food manufacturers' net profit in '50, as compared to 14.7% in '29.

Food corporation sales accounted for an average of 19.6% of total business for all manufacturing between 1929 and 1950. And in that period, our industry's sales increased 288%.



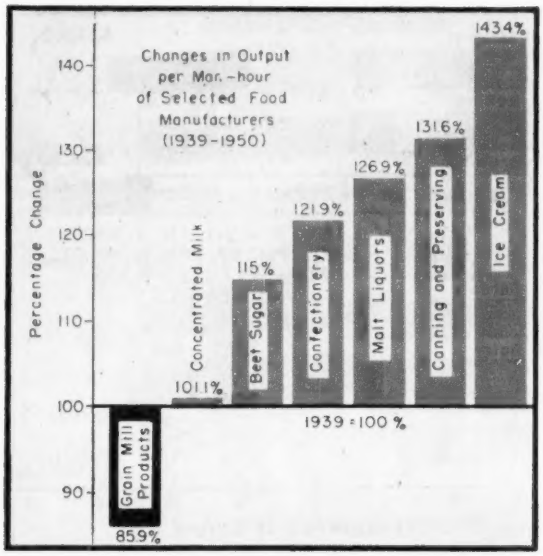
Mortality is greatest among small food plants.

Though the total number of food corporations declined slightly, the percentage of corporate to total increased from 39.5% to 48.7% between 1939 and '47. And this has since been enlarged, due to the decline in number of unincorporated concerns.

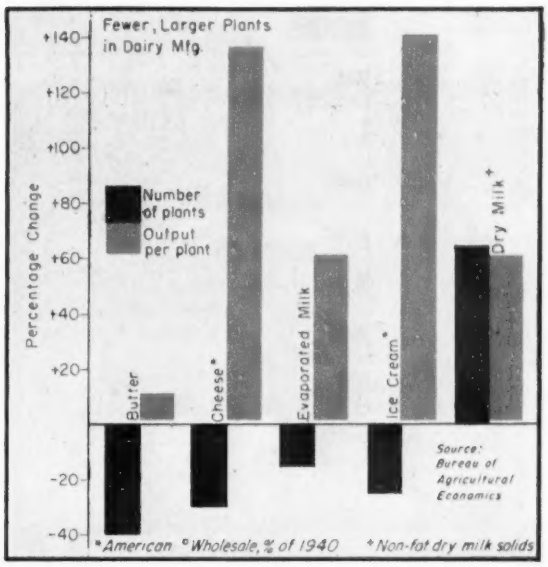
While the value added by manufacture, per food corporation, increased more than 2½ times during the eight years between 1939 and 1947, value added by the unincorporated group increased more than 3 times. Nevertheless, value added per corporate food enterprise was 8½ times as much in 1947 as per unincorporated unit.

Just as the trend of our industry toward more corporate enterprises is in reverse direction to that of other manufacturers, so likewise is the trend of food manufacture structure toward multi-plant operations. Multi-unit

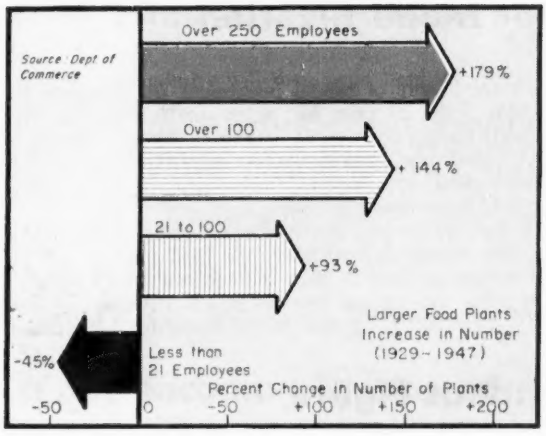
Productivity is up in 5 branches, down in 1.



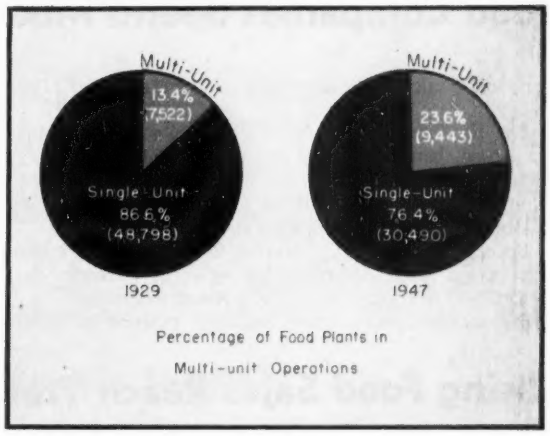
Dairy plants reflect sharp size-output trend.



Largest food factories increase most rapidly.



And larger multi-unit operations enjoy increase.



But They Are Larger and More Efficient

food plants accounted for 49% of value added by manufacture in 1929; for 61% in 1947.

Occurring during a period of general prosperity and spiraling food industry sales, the immense shrinkage in the number of sole proprietorships and partnerships, and also the smaller decrease in the number of corporations, indicate an era of intense consolidation. Multi-unit operation, it appears, is the vehicle increasingly employed to consolidate management.

Magnitude of this basic trend toward consolidation of the food industry into fewer plants of greatly increased production capacity is dramatically shown in the charts.

Inside story of the industry's consolidation is revealing, not only in its portrayal of the history of the changes and causes, but also because it foreshadows the future.

Here it is:

In 1944 approximately 1,300 new food manufacturing businesses came into the ring. During the same period some 2,100 took the count, for a net loss of 800 food businesses. The score for the 9 years is a decrease in the number of food plants of approximately 17,000.

Counting the transfers as well as new and decreased businesses, 77,000 changes occurred in less than 10 years. And this in an industry which had less than half that number of businesses at the beginning of the period. That is change without precedent.

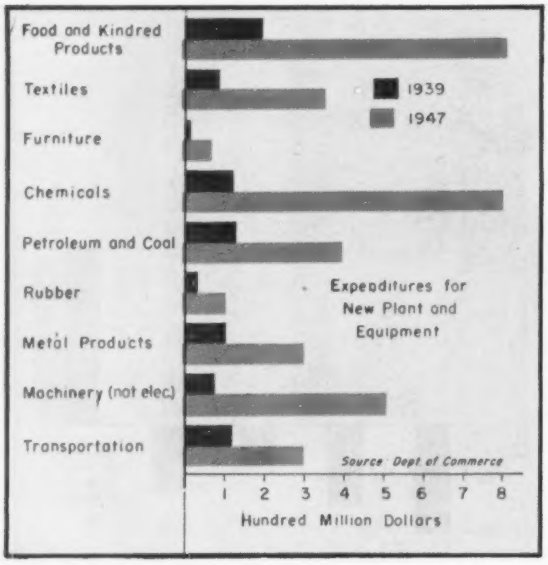
Though there were losses among concerns with more than 21 employees, gains balanced losses for a draw score. It was the small operations with less than 21 employees that took it on the chin.

Mere size alone cannot be blamed. Small establishments in other manufacturing industries have thrived. In all manufacturing other than food, the number of plants with less than 21 employees increased 22% from '29 to '47, while food establishments of that size decreased 45%. *Apparently, the mortality of small food plants is the result of changes taking place within the industry itself.*

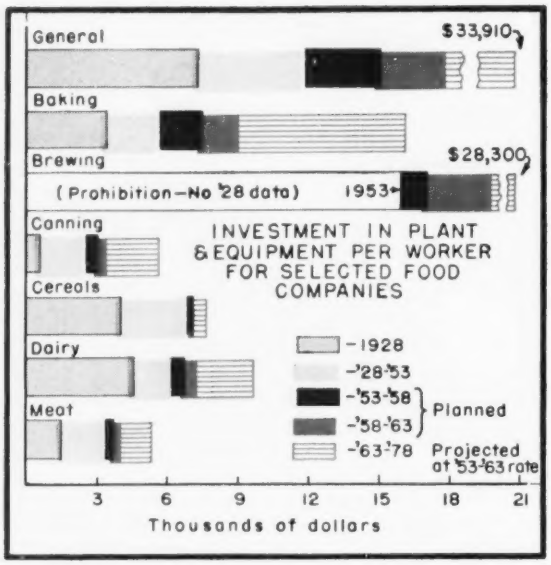
Before examining these changes, and their causes, let's finish our scrutiny of size, growth, and consolidation:

A little over 5% of food companies are doing very well, thank you. In '47 their sales volume was 90.5% of total food manufacturer sales, averaging $15,150,000 per com-

Industry spends most for plant and equipment.



And leading firms step up capital expenditures.



Food Companies Spend Much for Modernization

pany while sales of the remaining concerns averaged $140,-000.

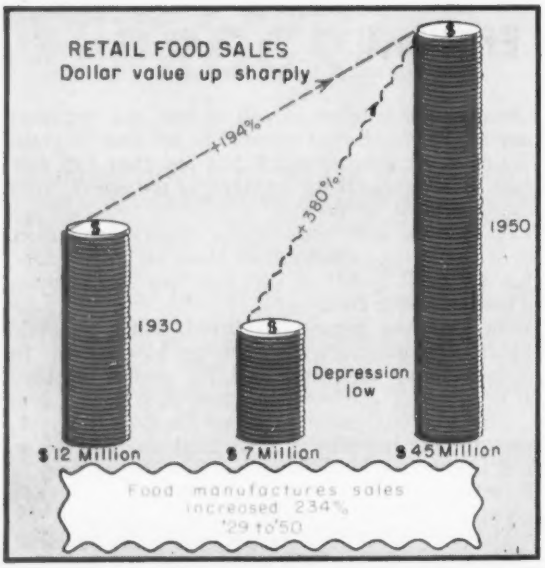
But the inference should not be drawn that the ranks are closed, barring progress except at the top. Each size group above 20 employees has had seam-bursting growth, as an increasing proportion of plants in each size group has been promoted to the ones above.

Success in food manufacturing depends on more than size at the start. However, the evidence indicates that success will not linger long if size remains dormant.

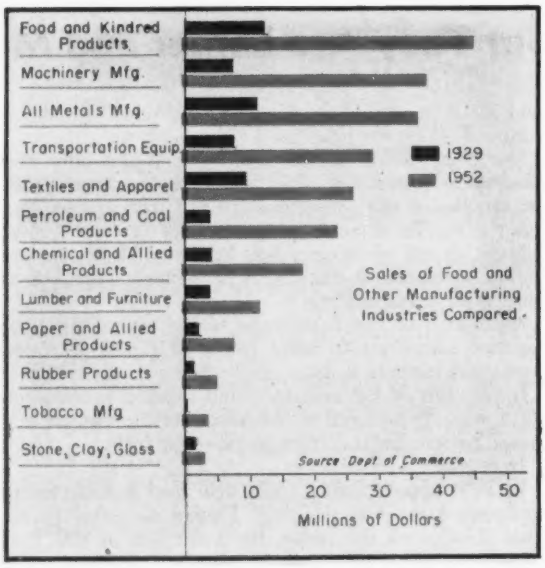
No measure more nearly indicates progress or failure than the history of capital investment per employee to provide better facilities for higher productivity. In this respect, leading food manufacturers have been setting a pretty good pace. And shown on one of the charts are the past, present, and projected investments of typical leading food firms of various types.

Before the current, government-induced, durable-goods-industry expansion-for-defense, the food industry led all other manufacturers in plant and equipment expenditures, increasing the amount invested 323% between '39 and '47. Very likely, as the forced spending for defense

Rising Food Sales Reach Tremendous Figure

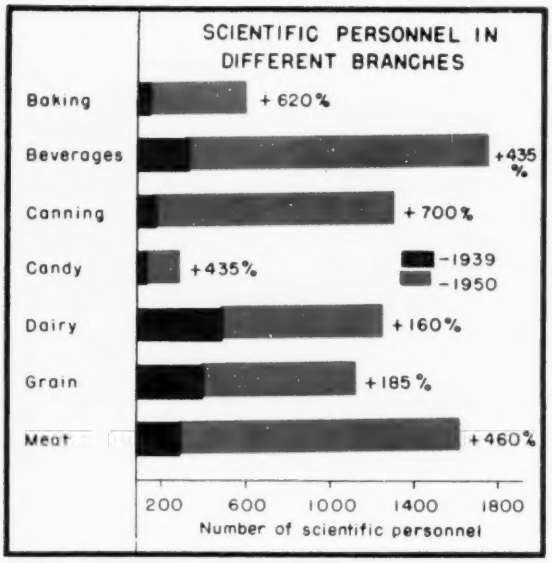


Food sales value nearly doubles in two decades.

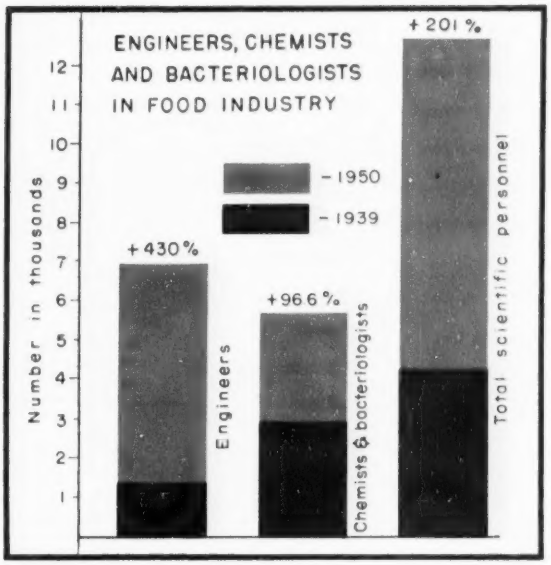


And food industry leads others in value of sales.

More technical men employed in various branches.



And engineers lead chemists in industry gain.



And They Employ More Technical Personnel

slackens, the industry will then again head all others in plant and equipment expenditures.

Further evidence of the industry's use of the machine is found in its increased use of electrical energy. Kwhr. consumption of 11,085 million in 1951, was an increase of 166% over '29.

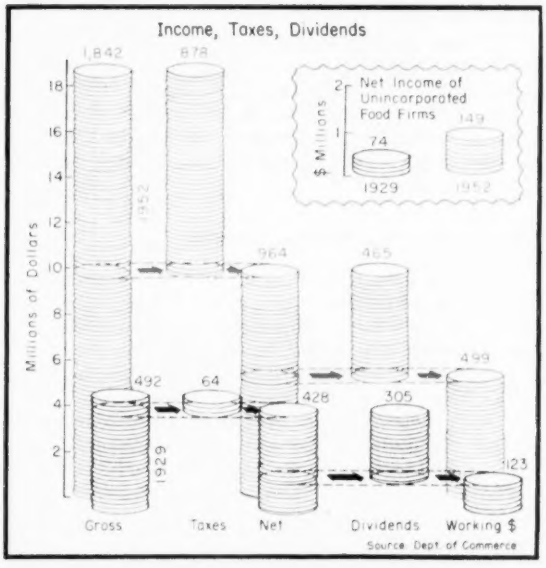
Output per man-hour of the manufacturing industries has more than doubled since the turn of the century, keeping uniform pace with "real" average hourly earnings.

Output in each food industry division has increased as plants were modernized. A case in point is ice cream manufacture, where continuous processing and other mechanization have increased output per man-hour 143.4%.

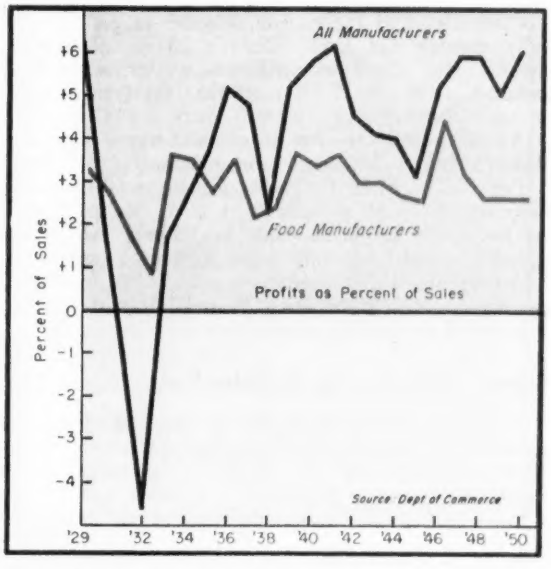
Mechanization of forming and coating operations in modernized confectionery plants, coupled with faster packaging, has brought similar increased output per man-hour to the candy maker of 121.9%.

At present, the milling division of the industry, facing a slowly declining per capita consumption, finds itself with excess capacity, and decreased output per manhour.

While Income−Taxes=Small, Stable Profit

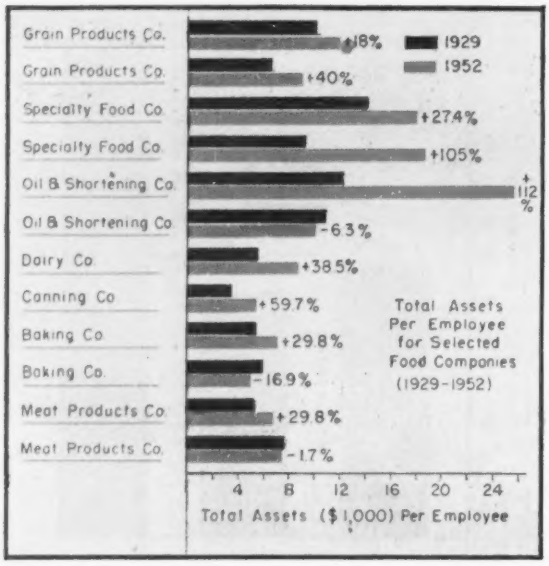


Industry's income high, but taxes take half.

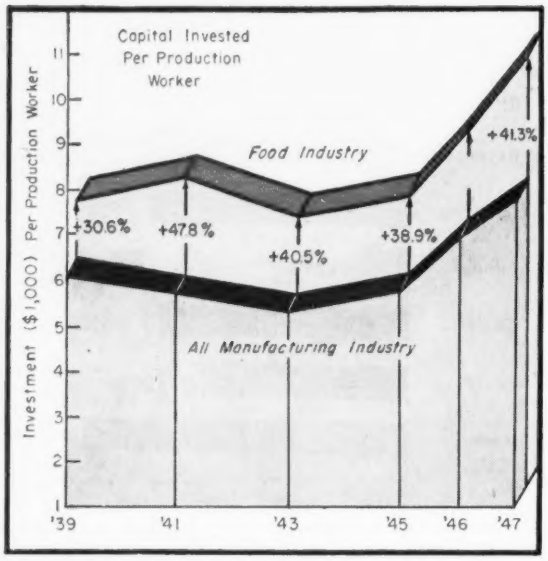


Food manufacturers' profits modest but steady.

How the different branches compare on assets.



Industry above average in investment per worker.



Assets Invested Per Worker Are Increasing

But modern, large-capacity plants will change this picture as consolidation in grain milling continues.

With rare exception, shrinkage in the number of plants has been accompanied by a considerable increase in output per plant. This results in a reduction of general overhead, whether accompanied by an increase in output per man-hour or not.

Value added by manufacturer, both per production worker and per plant, provides a relative picture more significant than most other measurements of growth and progress.

In food manufacturing value added per production worker jumped from $4,500 in 1929 to $8,930 a 98.5% increase. Value added per food plant increased 275%. For other manufacturers, the increases were 71.4% and 72% respectively.

Comparisons of the relative increases of each do not fully measure the food industry's 20-year accomplishment. Value added per production worker in the food industry in '29 was 27.5% more than the average added in other manufacturing, and 48% more in 1947.

Amount remaining after salaries and wages have been deducted from value added by manufacture is gross profit.

Between 1929 and 1947, this precious small increment increased for food manufacturers 67% per production worker, 250% per plant. This is additional evidence of industry consolidation into larger production units.

Average number of production workers per food plant more than doubled between '29 and '47, with a much accelerated increase per plant during the following 6 years.

Science Aids Mr. Big, Cripples Tiny

There can be little doubt that the extensive adoption of continuous processing, mechanized to the extent of complete pushbutton control, should be attributed to the rapid enlargement of the industry's scientific staff and the legion of technical advances they have made during the last 25 years.

In its early use of the scientist, the industry turned to the chemist and bacteriologist. Though food manufacturers continue to add these technicians, growth of engineers has been much more accelerated, there being a 430% increase since 1930. Engineers are much needed to apply the advanced developments of the technologists.

Among the engineers in '50, mechanical predominated, next were chemical engineers, followed closely by industrial engineers. However, engineers are used much more extensively by other manufacturers.

When the staff of scientists engaged in research and development is compared to the same type groups in other manufacturing, our industry shows up at the tail end.

National investment in research and development in 1952 was $3½ billion, with manufacturing industry's share $1.6 billion, while the food industry contributed only $23 million.

As with sales, engineering personnel and laboratory facilities are concentrated in large concerns.

One food company includes approximately 600 scientists and supporting personnel in its quality control and research operation. Another's count reaches near 400.

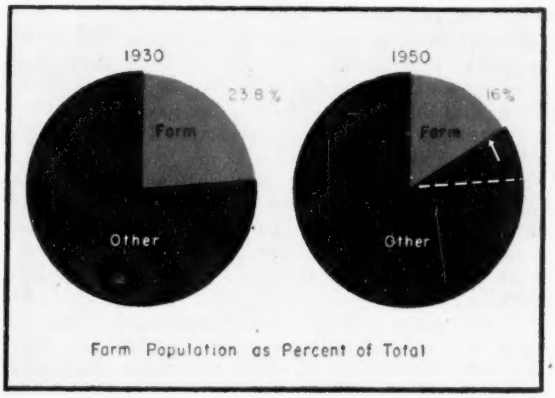
Admittedly, cases cited are at the extreme end of the scale. At the other are numerous concerns that do their best—by guess. These are handicapped in their quest for growth and progress.

Fast Tempo, Accelerated Growth

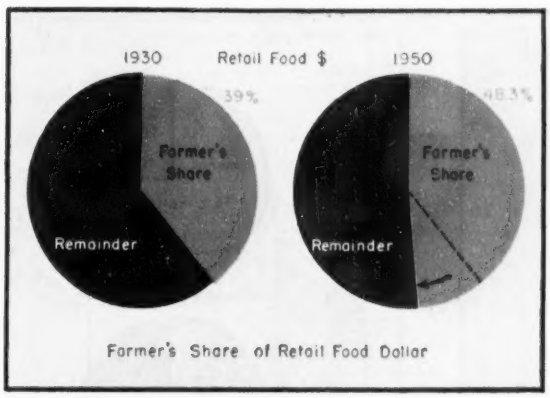
During the span from 1929 to 1952, food-manufacturer sales increased from $12 billion to $45 billion, a 275% increase in dollar volume. This sounds impressive even when compared with the record of all manufacturers, whose sales increase was from $70 billion to $276 billion—a 293% climb.

More impressive is the dizzy climb in sales per plant, whether the comparison is with the food manufacturer's own records or with those of all other manufacturers. Average sales per food plant jumped from $214,000 in '29 of $1,000,000 in '52, while sales of all other manufacturers moved up from $292,000 to $850,000. Discussed later will be some of the reasons behind this shift, revealing a basic trend in the food industry.

Percentage of farmers in population shrinks.



Yet farmers get bigger slice of food dollar.



Fewer Farmers Are Receiving More Food Dollars

Food manufacturers' total sales and sales per plant top the list, accounting today for almost as much of the sales of all manufacturing as in 1929. And this accomplishment without billion dollar defense contracts! And despite new or fast-growing non-food industries such as electronics, nuclonics, aviation, and petroleum.

Forces Affecting Size

At this point it should prove helpful to assemble some of the fundamental forces shaping the destiny of the industry. To a major extent these factors, each of which will be discussed in detail, account for the basic trend—intensive consolidation of the industry into fewer and larger units.

Here are the conditions stimulating the growth of larger units, and at the same time contributing to the mortality of an increasing portion of the small concerns:

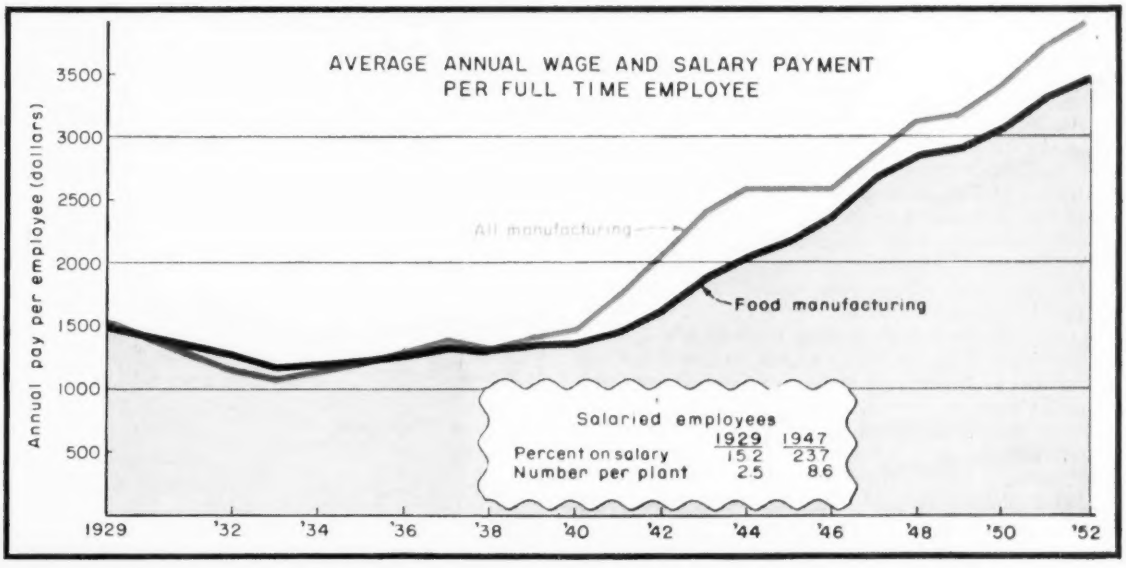
1. Pyramiding taxes
2. Mounting cost of labor, including both the direct cost and the expense of supplements
3. Multiplying government regulations
4. Upward spiraling cost of administration
5. Increased raw material costs
6. Accelerated forward strides in technology and food plant engineering
7. Continuous processing
8. Modern packaging requirements
9. Shift in consumer preference

Other Side of Picture

Unfortunately, sales comprise but one index of accomplishment. Sales volume may mirror size, however it is no gage of worth, which is best measured by profits.

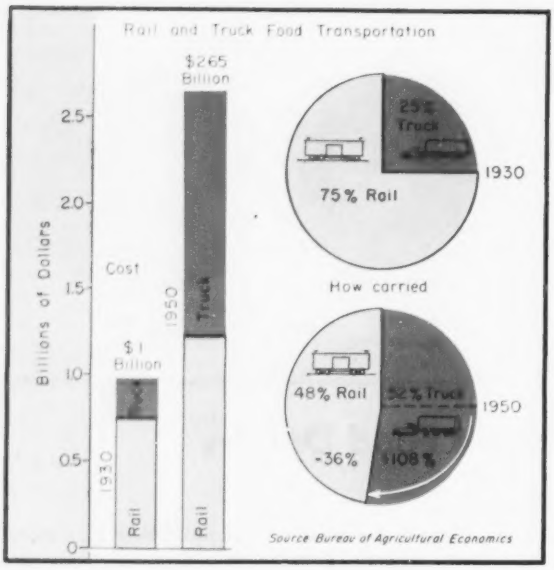
Gross income of food corporations (unincorporated en-

Workers Wages and Salaries Have Increased Greatly



More employees in fewer food factories are paid constantly increasing wages and salaries.

Trucks gain rapidly as shipping expenses soar.



More Transportation $$$

terprises not included) was 2¾ times as much in '50 as in '29. This may appear like "bringing home the bacon"—until a comparison is made with all other manufacturers, whose gross profits increased better than 3¾ times during the same period.

Gross income does not come pre-shrunk, so let's have a squint at federal and state corporate income and excess profits taxes, then lament what little is left. Food corporation taxes increased 13.7 times between '29 and '50—taxes of all other manufacturing corporations increased 17.5 times.

Impact of Taxes

In his favor, the food manufacturer had a generally increasing market to absorb his production increase between '29 and '50 of 64%. This enlarged production plus increased market prices (retail expenditure jumped 192%) netted the industry a 234% gain in dollar sales.

These have been but modest gains with which to meet the rise in taxes, a burden which grew 1,270% heavier during the 21 years following '29.

In fact, food corporations contribute to government tax coffers a greater proportion of their gross earnings than do other manufacturing companies.

Rising taxes have been one condition forcing surviving concerns to improve products, mechanize, reduce operating costs and overhead, and expand—necessities of the period not afforded by all.

Even in the face of pyramiding taxes (nearly 1,400% increase since '29), food corporations squeezed out approximately $1 billion net income in '50. Though this was a 125% greater net than in '29, food producing corporations were outdistanced by other corporate manufacturers. Net income of latter increased in '50 over 200% as compared to '29.

After dividends were paid, food corporations salted away, as undistributed income, a $½ billion in 1950. This set-aside of 1.24% of sales was proportionately more than the 1.02% nest egg in '29.

For several decades, government has been determined to bring to the farmer a larger share of national income. This objective has been accomplished by government by well known means.

Farm population, which was 23.8% of the total in '30, dropped to 16% in 1950. Nevertheless, the farmers' share of the retail food dollar rose from 39% in 1930 to 48.3% in '50, thus shrinking the share of the food manufacturer and distributor. Farm food value increased 157% (1929–1947); retail value of food 92%.

Purchase price of raw materials has a more vital influence on food manufacturer profits than on those of most other manufacturers. Though the industry has never failed to show a profit (even during the depth of the depression), the portion of the sales dollar left as profit is at best only a mite.

In this constant squeeze play of raw material costs on profits, with cost of materials (including packaging) averaging between 65 and 70% of the sales dollar, the crucial importance of raw food prices to the small operator is obvious.

In general, however, food companies may find some consolation in the increased price paid farmers, for there is a silver lining in one small cloud. The farmer, formerly almost food-self-sufficient, is now a dependent customer of the food processor.

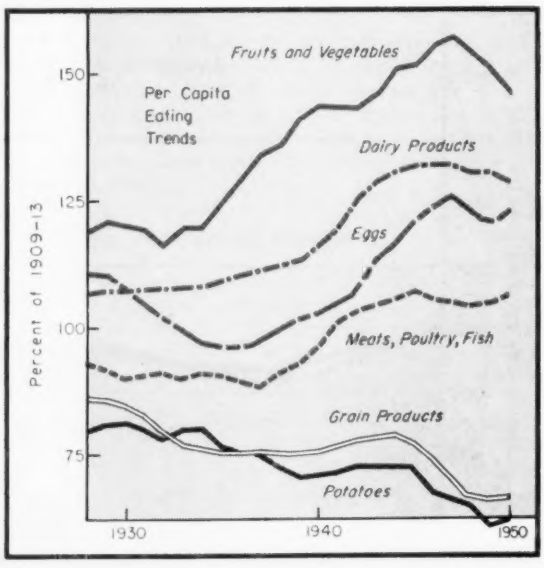
Raising freight rates have been the source of considerable concern, no doubt, to all food manufacturers. Unlike the cost of raw materials, rates do not fluctuate. Throughout freight rate history, common carrier transportation costs do go up consistently, but never down.

However, the increase in rail rates has been less than 70% since '29. And freight costs of most packaged foods, except frozen, are usually not more than 4-5% of the wholesale price.

Trucking has entered extensively into transportation of food, both to plants and to market. While payments to rail carriers increased 62% since 1930, payments to trucking concerns went up 419%. This figure does not take into account the processors' increasing use of their own vehicles.

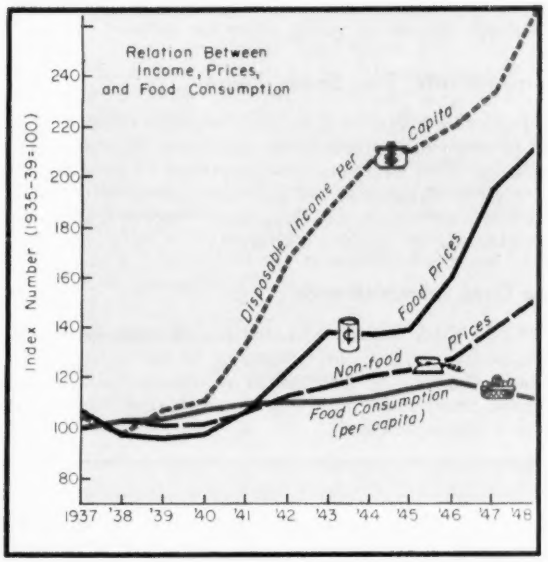
There are three ways, and three ways only, in which

Food Preferences Change

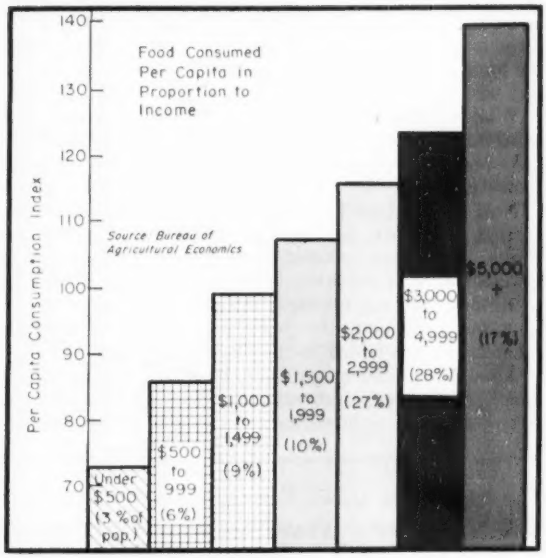


Four basic foods up, two suffer per-capita loss.

Economic trends affect food-consumption curve.



More money they make, the better they eat.



General Economic Trends Affect Eating Habits

food manufacturers can enlarge the tonnage of their sales. A steady growth comes from the gradual increase in population (29.4% increase 1929–May 1953). Largest potential field for tonnage expansion is at the expense of unprocessed foods. The one other means is through increased per capita consumption, which is geared directly to consumer income.

Since '29, processors, through a 64% up in production, have raised the ratio of processed food to fresh. General prosperity has brought them expanded dollar sales as well as greater per capita food consumption.

Though major changes in per capita consumption of basic foods have been gradual, many minor shifts of consumer preference have been sharp in decline or rise.

Particulary is this true of the competition between fresh and processed foods. Fortunately for the manufacturer, processed foods are just now winning all of these contests.

Always, too, there is conflict between processed foods as well as processed vs. fresh. One such hard-fought contest is of recent origin. For many years, single-strength citrus juice canners have been pitted against fresh fruit packers, gaining ground consistently (canned grapefruit juice rose from 2% of the crop in '30 to approximately 65% in '49). In 1945 a new virile contestant, frozen concentrated juice, entered the fight. Now, not only is fresh citrus loosing ground, but single-strength juice as well.

Producing frozen concentrated juice requires enormous outlay of capital for equipment. Recent investment in one plant was $3½ million. Even though only a few can afford this, already the field is crowded, with competition severe—among the concentrators as well as throughout the entire citrus field.

Dr. Jekyll and Mr. Hyde

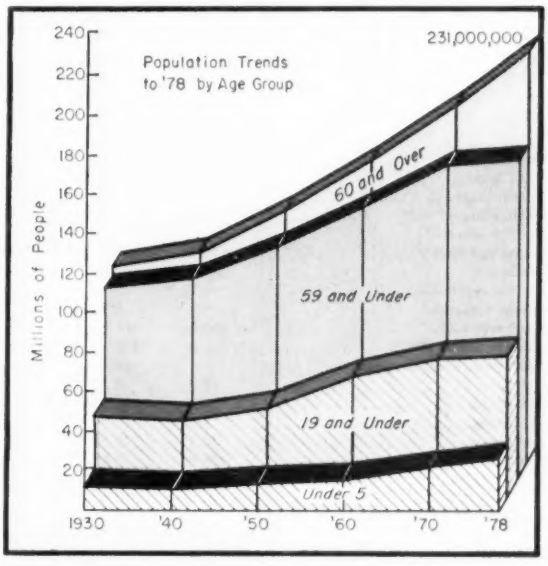
The 46% rise in production workers since 1929 seems well in line with the industry's 64% climb in production volume. Even the 185% increase in wages would seem reasonable compared to the industry's 234% rise in dollar sales, had all other cost elements remained the same.

But increasing cost of employment has not come from wages alone. By '50, salaries and wages had zoomed 197% and supplements over 1,200%, raising the total cost of employment 212% above the level in 1929.

Difficult as it may be for many food concerns to meet today's great cost of employees, manufacturers as a whole should be the last to begrudge the share of national income that is now bestowed on labor.

Although labor's portion of national income has risen

Big Food Demand in 1978



71 million more mouths to feed in 25 years.

from 48.7% of gross national product in '29 to 55.5% in '52, the food industry has reaped as much of the gain as labor. For as a consumer-unit is raised to a higher income bracket, a larger percent of the total income is spent for food, while the percent invested in most other goods and services declines.

When wages are high, food buying is no longer confined to necessities. Then, appetite-appeasing food luxuries become increasingly a substantial part of the worker-family menu.

Now, let's return from digressing, to the effect of increased labor costs on large and small operations. When capital is available, labor costs per unit of product can be lowered through mechanization, usually accompanied by expansion. When, however, dearth of finance prohibits such mechanization, the profit margin shrinks until another casualty is added to the already-long list.

Though at times an individual food manufacturer may "beef" about a regulation that increases *his* cost of operations—denouncing government in general for encroaching on the perogatives of industry—food processors as a whole are well aware of the necessity for governments to establish standards, to regulate and to police the industry.

Governments, Too, Shape Trend

Regardless of the need for, and long-demonstrated value of, government regulations, the cost must be borne by the industry. The price for "services rendered" involves cost of sanitary equipment and instrumentation, control laboratories and labor for inspection, check-weighing and maintenance of required sanitation.

Up Goes Administration

All of these require expanded administration. Regardless of the unquestioned advantages to the industry as a whole, the cost of government regulations falls heavily on the small concerns, where the cost cannot be spread over a large operation.

DYNAMIC DATA

SCIENTISTS AND STAFFS of Research and Development Laboratories in Manufacturing Industries, 1951*

	Number of Research Engineers and Scientists	Other Research Employees	Cost of Research and Development (000 omitted)	Percent Financed by Government	Cost as Percent of Sales
All manufacturing	79,303	196,517	$1,613,493	46.5	2.0
Food & kindred prod.	1,357	2,941	23,764	3.7	0.3
Textile prod.	734	1,989	15,817	14.4	0.9
Chemical prod.	13,181	23,211	204,170	17.1	2.5
Petroleum prod.	4,953	12,393	92,942	3.1	0.6
Stone, clay & glass	1,210	3,115	20,752	2.7	1.3
Primary metals	1,703	3,705	34,415	9.5	0.4
Fabricated metals	2,491	5,311	38,404	31.1	0.9
Machinery (except elect.)	5,333	12,688	99,334	23.9	1.5
Electrical mach.	17,243	51,172	431,948	57.0	6.4
Transportation equip.	21,857	59,243	510,605	70.7	4.5
Instruments	5,694	13,442	91,447	57.6	7.5
Other mfg.	3,547	7,327	49,895	31.4	0.8

* From Preliminary 1952 Report of BLS and Research & Development Board of Department of Defense. Estimated coverage is 85% of all research and development laboratories operated in 1951.

PER CAPITA Consumption of Selected Fresh and Processed Foods, 1929-1952

	Lb. of Food		Percent Change
	1929	1952	
Canned fruits	12.5	19.7	+ 58.0
Fruit juices	0.1	13.9	+.....
Frozen fruits	0.5	5.5	+1,100.0
Total processed fruits	19.3	43.6	+126.0
Fresh fruits	149.6	113.0	− 32.4
Wheat as human food	179.0	135.0	− 32.6
All cereals	241.7	182.2	− 32.6
Canned vegetables	23.6	41.2	+ 75.0
Frozen vegetables	.....	4.15	+.....
Fresh vegetables	206.0	241.0	+ 17.0
Potatoes sweet & irish	174.5	109.5	− 59.6
Baby food (per child under 3)	.....	47.4	+.....
Butter	17.4	8.7	− 50.0
Margarine	2.6	7.7	+196.0
Shortening	9.3	10.0	+ 7.5
Lard	13.1	12.2	− 6.9
Meat	139.8	153.0	+ 9.4
Fish	12.2	11.0	− 9.8
Poultry	64.6	87.8	+ 35.8
Cheese	4.4	7.5	+ 70.4
Concentrated milk	12.0	17.9	+ 49.2
Dry milk	1.6	4.5	+181.0
Ice cream	22.8	44.1	+ 93.4

INDEXES to Size of Multi-Unit Food Plant Operations, 1947

	Multi-Unit Control	Single Independents
Plants	23.6%	76.4%
Total employees	55.6	44.4
Salaries & wages	56.8	43.2
Production workers	56.2	43.8
Wages	59.0	41.0
Value added by mfg.	61.0	39.0

CHANGE IN NUMBER of Food Establishments by Divisions of Industry, 1929-1947

	Number			Percent Change
	(1929)	(1947)	Change	
Meat packing wholesale	1,277	2,153	+876	+ 68.4
Processed meat	681	1,264	+583	+ 46.1
Poultry dressing	485	557	+ 72	+ 14.8
Creamery butter	3,527	1,633	− 1,894	− 53.8
Cheese	2,758	1,711	− 1,048	− 38.0
Concentrated milk	535	428	−107	− 20.0
Ice cream	3,150	1,521	− 1,629	− 51.7
Canned seafood	348	381	+ 33	+ 9.5
Flour, etc.	4,022	1,243	− 2,779	− 69.0
Prepared feeds	750	2,689	+ 1,939	+259.0
All canning, drying, freezing	2,997	3,445	+448	+ 15.0
Cereal prep.	121	64	− 57	− 47.0
Processed rice	60	88	+ 28	+ 46.0
Bread & crackers & pretzels, etc.	20,785	7,123	−13,662	− 65.0
Raw sugar	70	82	+ 12	+ 17.1
Cane sugar ref.	21	25	+ 4	+ 19.0
Beet sugar	82	74	− 8	− 9.8
Confectionery	2,021	1,686	−335	− 16.6
Chocolate & cocoa	59	31	− 28	− 47.0
Chewing gum	37	(No change)	.....	.....
Beverages (non-alcoholic)	5,154	6,058	+904	+ 17.5
Manufactured ice	4,110	3,432	−678	− 16.5
Macaroni & spaghetti	353	226	−127	− 36.0
Malt	28	53	+ 25	+ 89.0
Leavening compounds	48	(No change)	.....	.....
Shortening & cooking oils	40	100	+ 60	+150.0
Margarine	41	27	− 14	− 34.0
Corn products	35	55	+ 20	+ 57.0
Flavorings	642	606	− 36	− 5.6
Vinegar & cider	172	118	− 54	− 31.0
Other foods	1,921	1,925	+ 4	.....
Food Industry	56,320	39,933	−16,387	− 29.2

Pyramiding taxes have forced an increase in administrative personnel. Labor, too, has contributed to this upswing.

As the cost of workers rose, more supervision was needed to obtain proportionately increased productivity. In addition, vastly enlarged and varied supplements to wages called for more office help and management direction. And government continues to pile on its load. The "red tape" that goes with ever increasing regulations, forces use of more and more non-productive personnel, while meeting the requirements of the "laws" adds to both productive and supervisory groups.

Is it any wonder that the small operator is unable to grow big fast enough to stay in business?

Looking Ahead

During the last 25 years population increased approximately 30%.

Forecast for the year 1978 is 231 million, a 44% growth in the next quarter century. With the past increase, processed food production jumped 64%. Predicted quarter-century growth may be expected to expand production at least 100%.

100 Billion Market

If spendable family income in low-pay brackets does not change, per capita consumption of food will remain relatively stationary. However, if the trend toward lifting low incomes continues, the industry can count on increased per capita sales.

Due to product improvement and cost-reduction methods, industry's inroads into the fresh food market will continue—and at an accelerated rate compared to past years.

Combined effect of these three factors indicates 100-125 billion dollar food sales ('53 dollars) in 1978, and an annual plant and equipment expenditure of 1½-2 billion dollars.

ON KEY TRENDS

VALUE ADDED Per Production Worker and Per Plant for Divisions of Food Industry, 1929-1947

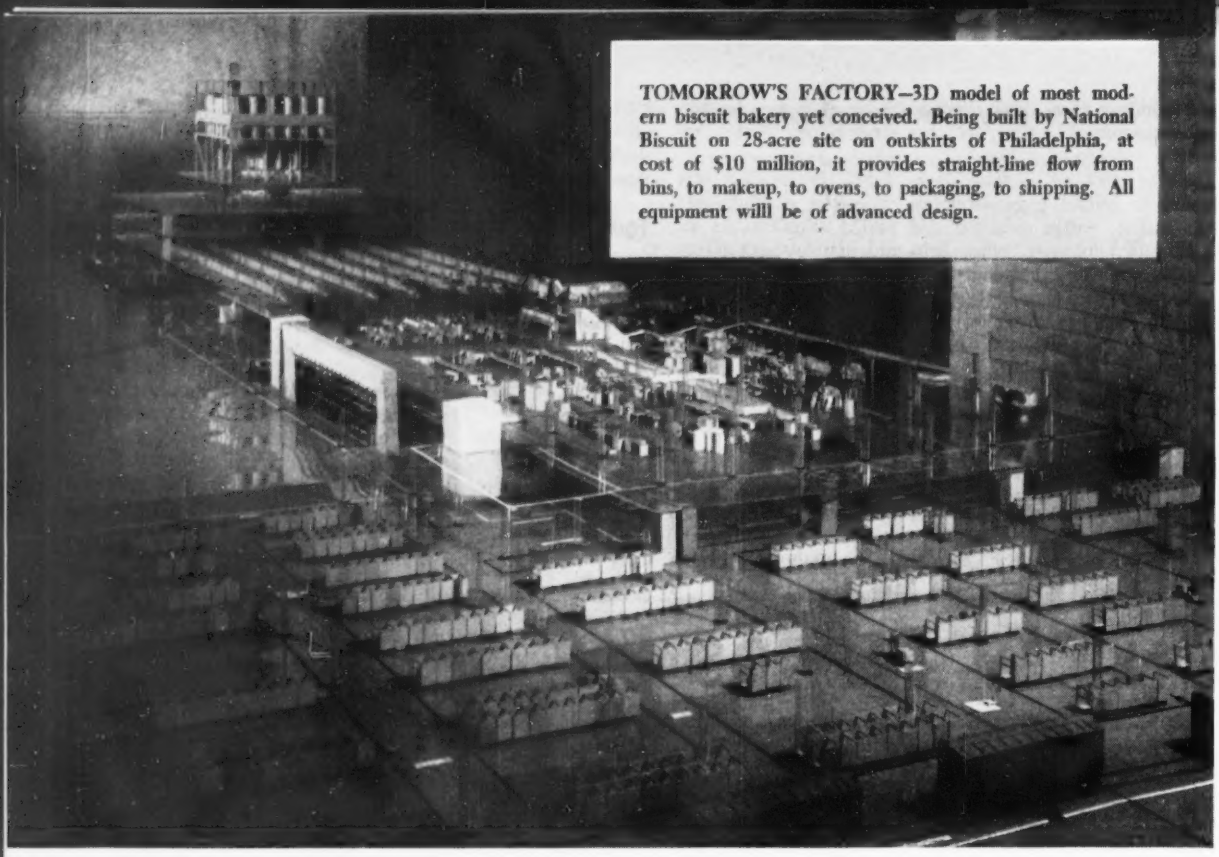
	Value Added per Worker			Value Added per Plant		
	1929	1947	Percent Change 1929 to 1947	1929	1947	Percent Change 1929 to 1947
Meat packing wholesale	$3,760	5,840	+ 55.3	$360,000	453,000	+ 25.8
Prepared meats	4,550	6,840	+ 50.4	39,400	186,000	+372.0
Poultry dressing	3,065	3,550	+ 15.8	48,000	122,000	+133.0
Creamery butter	5,800	7,020	+ 21.0	31,400	65,300	+108.0
Natural cheese	5,260	6,000	+ 14.1	6,480	37,000	+470.0
Concentrated milk	6,400	10,640	+ 62.2	84,400	348,000	+312.0
Ice cream	7,440	9,840	+ 32.3	54,000	150,000	+177.5
Special dairy prod		7,820			367,000	
Canned seafood	2,030	5,130	+153.0	79,400	381,000	+380.0
Cured fish		4,640			78,200	
Canning & preserving	2,910	5,000	+ 72.0	96,200	269,000	+180.0
Dehydrated F.&V.		4,580			124,000	
Pickles, sauces & relishes		6,580			165,000	
Frozen foods		3,760			204,000	
Flour, etc.	7,110	13,380	+ 88.2	48,900	330,000	+574.0
Prepared feeds	7,310	9,820	+ 34.3	99,800	146,500	+ 46.8
Cereal preparations	11,360	13,230	+ 16.5	600,000	2,035,000	+239.0
Rice processing	6,520	13,300	+104.5	172,500	493,000	+186.5
Malt	7,930	25,500	+222.0	167,000	1,016,000	+508.0
Blended & prepared flour		10,100			191,000	
Bread, etc.	3,930	7,280	+ 85.3	38,000	162,000	+326.0
Crackers & biscuits		7,060			813,000	
Raw cane sugar	2,590	4,020	+ 55.2	80,000	216,000	+170.0
Cane sugar refiner	4,950	6,500	+ 31.3	3,000,000	3,925,000	+ 30.0
Beet sugar	5,010	10,150	+102.5	458,000	1,595,000	+248.0
Confectionery prod	2,800	6,480	+131.0	88,000	245,000	+178.0
Choclate & cocoa	6,400	12,730	+ 99.0	657,800	3,170,000	+382.0
Chewing gum	16,300	13,700	− 19.0	999,000	2,020,000	+103.0
Beverages, non-alcoholic	5,200	10,200	+ 96.0	32,500	75,000	+131.0
Malt liquor		12,700			1,838,000	
Wine & brandy		16,300			227,000	
Liquors		18,300			2,088,00	
Leavening compounds	9,900	19,650	+ 98.0	620,000	978,000	+ 57.8
Shortening & cooking oils	5,720	27,300	+377.0	380,000	1,621,000	+326.0
Margarine	12,000	24,200	+102.0	382,000	1,617,000	+324.0
Corn products	9,120	12,500	+ 38.4	1,750,000	2,310,000	+ 32.0
Flavorings	14,600	21,850	+ 49.7	114,500	261,000	+128.0
Vinegar & cider	5,690	4,230	− 25.6	25,750	29,700	+ 15.3
Manufactured ice	5,340	7,800	+ 41.1	41,600	66,000	+ 60.2
Macaroni & spaghetti	3,900	6,340	+ 62.6	52,200	185,700	+256.0
Eggs, dehy., frozen, etc.		3,700			209,000	
Other foods	6,440	10,000	+ 55.2	90,800	182,000	+101.0

90.5% of Production Accounted for by 5.6% of Companies . . . Biggest Firms Average $15,150,000 Sales . . . Others $140,000

PERCENTAGE of Business by 50 Largest Food Firms in Each Branch

	No. Companies	Value of Shipment First 50 Companies (000,000)	Percent of Total Shipments	Comparison Avg. Sales of 50 Largest and of Remainder
Meat packing (whol.)	1,999	$4,400	88.5	301 to 1
Prepared meats	941	2,190	62.5	296 to 1
Flour and meal	1,084	1,815	72.2	54 to 1
Bakery products	5,985	1,110	45.9	102 to 1
Prepared feeds	2,372	1,135	53.3	53 to 1
Canning & preserving	1,856	934	57.6	48 to 1
Brewing	404	844	64.0	13 to 1
Other food prod	1,801	851	64.8	64 to 1
Confectionery	1,620	530	56.1	40 to 1
Shortening & oils	68	884	100.0	
Liquors	144	852	98.0	83 to 1
Butter	1,482	356	42.2	21 to 1
Cane sugar	17	818	100.0	
Carbonated beverages	5,169	209	28.0	40 to 1
Concentrated milk	182	670	90.9	26 to 1
Ice cream	1,273	404	66.0	47 to 1
Biscuits, crackers, pretzels	249	508	94.2	63 to 1
Poultry dressing	330	370	76.6	18 to 1
Corn products	47	459	100.0	
Cheese (natural)	1,313	224	49.1	25 to 1
Pickles & sauces	637	274	75.1	35 to 1
Chocolate & cocoa prod	31	349	100.0	
Flavorings	582	352	80.3	48 to 1
Special dairy prod	77	287	98.6	103 to 1
Cereal preparations	55	284	100.0	
Manufactured ice	2,206	133	48.7	35 to 1
Beet sugar	17	262	100.0	
Malt	41	256	100.0	
Eggs (dried, frozen, etc.)	96	231	91.0	21 to 1
Canned seafood	228	186	82.4	17 to 1
Processed rice	75	220	97.8	23 to 1
Margarine	17	214	100.0	
Frozen foods	237	117	75.6	11 to 1
Chewing gum	35	148	100.0	
Macaroni & spaghetti	219	90	80.8	12 to 1
Prepared flours & mixes	115	70	93.6	22 to 1
Leavening agents	39	72	100.0	
Raw cane sugar	77	57	94.9	7 to 1
Dehydrated F.&V.	120	49	95.8	33 to 1
Cured fish	121	28	90.5	13 to 1
Vinegar & cider	88	6	95.1	2 to 1
Wine	379		74.4	

(Source: Special Government Report 1947)



TOMORROW'S FACTORY–3D model of most modern biscuit bakery yet conceived. Being built by National Biscuit on 28-acre site on outskirts of Philadelphia, at cost of $10 million, it provides straight-line flow from bins, to makeup, to ovens, to packaging, to shipping. All equipment willl be of advanced design.

FOOD PLANT of the FUTURE

WHILE THE FOOD PLANT of the future will be radically different from the average modern plant today, it will not be of Buck Rogers design.

As a matter of fact, the food plant of the future is in operation today, but not as one plant. Its advanced features–both in respect to process and construction–are scattered piecemeal through many branches of the food and other industries, or are found in pilot plants or in development departments.

Here is our quick concept of food manufacturing operations in the plant of the future, and it doesn't include anything that doesn't already exist somewhere.

Stretching parallel across a great expanse of open floor area–between receiving and shipping platforms–will be continuous, automatically operated process, materials handling, and packaging lines.

Bulk ingredients will be automatically proportioned into the lines where required in the formulation of the product, will be continuously mixed with other ingredients, then continuously processed. With no change of pace, the finished product will feed into packaging lines operating at speeds far faster than today's.

Packaging materials will feed from bulk roll into the packaging end of the line through automatic machines that form the containers and supply them at a rate synchronized with the speed of processing.

LAST WORD–Wesson Oil's big new plant still will be functionally sound in 1978. Located on 16½ acres 9 miles from Chicago's Loop, it will serve 15 states and save hundreds of thousands of dollars annually in shipping costs. It also will boost shortening capacity at Chicago 50% and cut operating costs. Factory includes 2-story office building, 3-story refinery, 1-story plant, power plant, and tank farm. (Courtesy The Austin Co.)

Only a small segment of any seasonal-food line will be one-product equipment, and it will be replaceable for production flexibility.

Ingredients will be stored close to point of use, either alongside or just above the equipment into which they feed. Materials warehouses will be eliminated in so far as possible to save building space and cost, to save the time and labor involved in putting materials into the warehouse and taking them out, to curtail spoilage, contamination, and insect damage, and to eliminate process delays.

Finished-product warehouses at the plant likewise will either be eliminated or reduced in size to mere surge points in most types of food factories. Finished products will go directly from the packaging line into trucks or railway cars to eliminate the high cost of factory warehousing and to reduce the amount of storage and shelf-life required for the product. This latter saving will in many instances reduce additive ingredient and packaging costs and will be made possible through quicker, more efficient distribution practices.

Operations Will Be Automatic

With but a few exceptions, processing and packaging lines will have no workers stationed along them. All operatons, and transfers between operations, will be automatic. One exception, which will hold for several years, is the product preparation phase of lines processing vegetables and fruits which must be inspected and sorted by people. No one has yet conceived a way, for example, of mechanically locating and trimming out defective spots in tomatoes. However, color meters and sorters are available, and before 1978 machines will pick defective tomatoes from a continuous belt or flume, position them in cutters, and remove the bad spots.

One must never lose sight of the incentive to automatize provided by steadily rising labor costs and the scarcity of high caliber workers. Nor should one forget that machines and gadgets considered fancy and impracticable ten years ago can be built in this electronic age. We have entered the automation era in American industry—including food manufacturing.

Directing the entire processing operations in this food factory of tomorrow will be a high-caliber production expert. He will be stationed in a glass-paneled control room above the production lines and overlooking the entire production area.

Before this expert in his tower will be a battery of instruments, signal lights, and alarms mounted on graphic panel boards. Every key process factor will be indicated and recorded by the instruments, and any deviation from proper operation will be immediately revealed by the automatic signals.

Television receivers, too, will be mounted in front of the process director. Wired to cameras at points in the process that require visual observation, the industrial TV screens will enable the director to watch for such emergencies as jam-ups in automatic feeds, off-color product discharging from an oven, and what not. This wired-circuit TV, incidentally, now costs little more per camera-receiver set than the annual wages of a competent worker. It will cost much less in future years.

Two-way radio communication will be installed in the control tower, too. This will enable the process director to call maintenance crews and direct their work, order lift-truck operators to points where needed, and direct replenishment of dwindling supplies. In a big canning operation, he will direct harvesting and hauling operations to keep his plant humming at maximum capacity or to avoid pileups at the receiving docks.

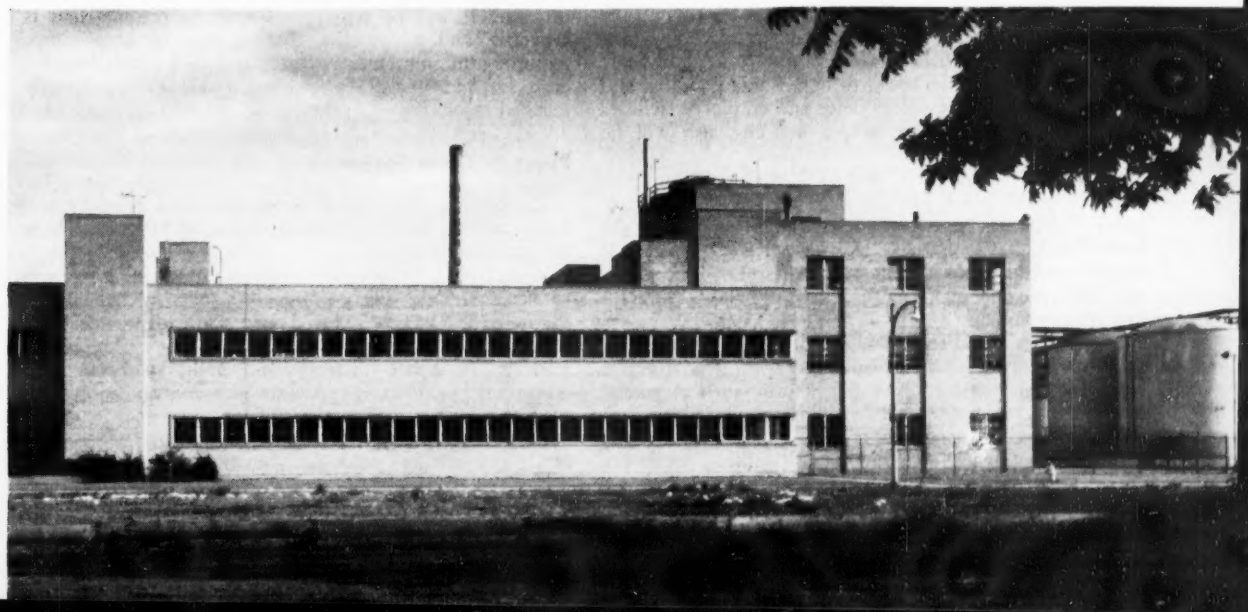
If all this sounds far-fetched, we must remember that the commonplace of today was, in many instances, the fantastic of a decade ago. And we must realize, too, that if your eye could sweep the horizons of industry, you would see nothing really new in the above concept.

Let's take some "for instances." Now in pilot-plant operation is an automatic sequence control for the Martin aseptic canning process. And we are privileged to tell you in detail just how this works in the foldout flowsheet on page 102 of this issue.

The significance of this control system extends far beyond the food process for which it was initially developed. It typifies integrated and interlocked control techniques adaptable to automation of complete food-plant operations. It will control not only heat transfer at critical temperatures, but also the mechanical operations of machines and conveyors. And what's more, it does not depend entirely upon end-point control but brings timers into play where end-points are missing.

Not only does this control contribute to efficient continuous operations but it maintains a positive guard over product quality—and under all contingencies.

If you're still skeptical, lets take another "for instance." One flour mill of the future already has been designed. No product of star-gazing, this mill incorporates commercially proved advanced equipment arranged for efficient continuous flow and integrated for automatic control. This is a pushbutton operation, and the mill is so compact that the building has much less floor space than



conventional modern mills of equal capacity today. And it is ever so much more sanitary, as well as being practically foolproof in respect to quality of the finished product. More, it involves no explosion hazards. Incidentally, a 1-story mill has been made possible by pneumatic handling

All of the processing, materials handling, and control components of the food plant of the future are discussed in the many articles on unit operations in this issue. Here we present only the overall concept, or paint the broad picture. One by one these articles will reveal to you the advances in machines and instruments which, when put end to end across the floor, will make up the process lines in the plant of tomorrow.

Economics Dictate Future Plans

By now you may be asking a big Why? Even if it can be done, you may question the advisability of such a factory as industry leaders foresee.

In that event, you will find the answers in the section of this issue covering the economics of technical progress. You will see that there is a sharp, inexorable, and ruthless trend toward efficient large food plants at the expense of the small units. This is a life-or-death trend for food manufacturing business, except, possibly the high-priced-specialty firms. Cost factors, particularly labor, make it necessary to operate with a high degree of efficiency.

This trend has created a demand for better unit operations, a demand that is being met by significant improvements at a surprising rate, as shown in other articles in this issue. Leaders in the field are quick to take advantage of these improvements.

And there you have the complete cycle involved in the trend to big efficient operations—just the way it has gone throughout American industry. The economic advantages of efficient mass production cannot be denied.

So in planning your plant of the future take heed of the forces that are pushing the trend to size and efficiency, then study the developments that make the efficiency possible and therefore accelerate the trend. It all ties together as cause and effect. And while the incentive is economic, the thing that makes the surprising trend of recent years possible is technical progress.

We designed this issue to give you the complete story—economic and technical. We believe it will help you in your plans for the future—from tomorrow to 1978.

Better Building Construction

As in other industries, there is a trend to one-story food plants. Multi-story construction no longer has a gravity-flow advantage. Mechanical and pneumatic movers do the job better, and faster, in automated processes. The one-story plants often will have a mezzanine to accommodate certain operations and a tower to house bulk handling and storage facilities. A two-story office and employee-facilities structure in front of the factory building also will be popular.

In exterior appearance, the food plant of tomorrow will look pretty much like the most attractive being built today. That is to say, it will have modern lines, but will be of functional design. It will have a wide expanse of window and glass-block areas to add "sanitary" attractiveness and provide good natural lighting and a pleasant inside environment.

Masonry as we know it today will not be widely used in the walls of future food plants, the cost of construction being too high. Materials in panel form—such as precast concrete, or preformed metal—will be employed to keep construction costs reasonable.

Slabs of sandwich construction are gaining preference rapidly. These have outside and inside wall surfaces over a core of insulating material.

On the inside, the plant of tomorrow will look little like the average food plant of today. Designed around the production lines, it will have broad expanses of floor area without roof-supporting columns. This will be required to house the process lines of tomorrow and permit flexibility and expansion. Roof-supporting steel work will be of light truss construction over these open floor spaces. And the steel work will be covered with attractive and sanitary ceilings, as obtained with sheet aluminum, reinforced plastic, or metal-clad plywood. And ceilings will hide overhead pipes, ducts, and conduit.

Interior walls in process areas will be of glazed tile, at least to shoulder height, or will be of sheet aluminum, metal-clad board, or plastic-impregnated fiberboard. Where paint is used on walls and ceilings, preference will be given to a bactericidal coating.

Floors will be of tile, chemical brick, terrazzo, or hard-surface bactericidal concrete in most plant areas, and asphalt sometimes will be employed where chemical and traffic conditions permit. There will be one notable exception, however. Many bakeries still prefer hardwood for its ease of cleaning, low maintenance, foot-comfort, and attractiveness.

Windows will be flush with the inside walls to eliminate dirt-collecting ledges, and the glass will be in corrosion-resistant sash. On sides of the building facing the sun, the glass will be tinted to keep out heat rays.

All joints between walls and floors will be curved and sealed to eliminate dirt-collecting crevices and corners.

Metal surfaces in the plant either will be corrosion resistant or will be coated with aluminum or plastic paint. And the latter will be used on those parts of equipment not of corrosion-resistant material.

Color engineering will determine plant interior decoration and will not only make the place attractive but will contribute to safety, employee satisfaction, and worker efficiency.

In areas housing noisy production operations, ceilings will be sound-dampened, perhaps by low-cost metal-baffle arrangements now being evaluated by researchers.

High-humidity departments, where condensation is a problem, sometimes will be located in an inside windowless room. This is planned for a beer pasteurizing operation, with packaging operations outside the room.

There definitely is a trend toward advanced fluid-milk-plant type of interior construction for other kinds of food factories. Sanitation and low maintenance are the reasons, as well as attractiveness.

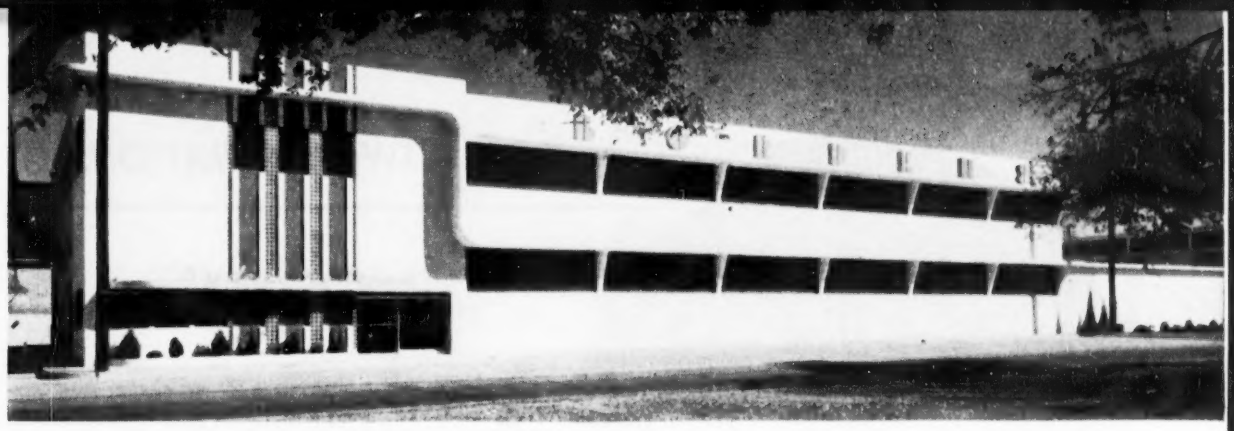
And whatever operation it houses, the food plant of the future will be architecturally designed around the process. It will be constructed with an exterior that is attractive and an interior that is easy to keep clean, requires minimum maintenance, and is a show-place for visitors. And it will be finished inside in scientifically selected colors.

Plant in Open Spaces

Continuing the current trend, the food plant of the future will be built in a suburban area or beyond. There are several reasons.

Tomorrow's factory will require considerable acreage to accommodate all operations on one or two floors. Secondly, it will take a lot of open space to provide these modern requirements: (1) Attractive show-place landscaping. (2) Space for trucks and employee parking and recreational facilities. (3) A clean surrounding atmosphere. (4) Space for waste disposal facilities.

So the plant must be placed in an area where real estate is much less expensive than that downtown.



'47 TO '78—Architects were looking to 1978 when they designed this Borden plant in Oklahoma City in 1947. Continuous windows, glass block panels, and concrete "awnings" provide eye-catching exterior and pleasant interior. Main structure is reinforced concrete. (Courtesy The Austin Co.)

Milk plants in 1978 will be in the dairy country, near the supply. Milk will be concentrated and packaged for shipment to market. Many other at-present city plants, such as sweet-goods bakeries, will move out, too. Products by that time will keep fresh longer and not require at-market manufacture.

In selecting the exact country-like spot for the plant, prime consideration must be given to available transportation facilities—for employees as well as for incoming materials and outgoing finished products.

Frequent and fast shipping will be required to eliminate large receiving and shipping warehouses. Because most materials will be bought in bulk, a railroad spur alongside the plant is highly desirable. And quick, easy access to a modern highway will be required to facilitate movement of trucks to and from the plant and to provide bus service for workers.

Plants requiring large volumes of water will be placed in an area where wells can be drilled. Yet water requirements will be much lower per unit of production than now, because less water will be wasted and modern water-treatment facilities will permit reuse.

Advanced Auxiliaries

Because of its practical benefits, complete air conditioning will be installed in nearly all areas of the food plant of 1978—from ingredient and materials receiving, through processing, to packaging and shipping.

Heavy pollution of streams with waste, and of air with smoke and odors, will be avoided. Waste treatment facilities will be more widely used, and more efficient.

Smoke will be eliminated by accurately controlled combustion and electrostatic precipitation. Flavor odors will be avoided by condensation of volatiles from processes, and return of condensate to product. Other odorous materials will be oxidized in a catalytic unit as they leave the plant. Dust will be sucked up at its source and collected in cyclones or filters.

Maintenance Machine Shop

Every food plant of the future will have well-equipped machine and electrical shops. Skilled machinists will keep equipment in first-class condition by preventive maintenance. Other skilled technicians will test and repair electrical and electronic equipment, as well as control instruments.

In the automatic plant, testing and preventive maintenance will be highly developed services. Equipment will be complex and down-time very costly in high-capacity operations.

Light and Power

There will be at least two kinds of lamps in the food plant of the future—ultraviolet and fluorescent. The first, of course, will produce bactericidal wave-lengths for sanitation.

For visual illumination, fluorescent lamps of high combined intensity (up to 100 ft.-candles) will be installed in ceiling-flush fixtures over work areas. And "ceilings of light", consisting of closely spaced continuous runs of fluorescent tubes over a diffusion grille or glass, will be seen in some show-place plant areas.

In addition to general lighting, there will be high-intensity daylight-type fluorescent lights immediately over critical work and inspection points. The new fluorescent-mercury lamp, giving the desirable light quality obtained by a combination of "cold" fluorescents and "warm" incandescents, will be popular.

Much more attention will be paid to efficient plant service facilities in the food plant of the future. The average plant today is woefully behind the times in this respect.

In food plants with low steam requirements, steam will be generated in small automatic packaged boilers, located near principal steam and hot-water demand points, rather than in a central power house, to reduce heat losses and minimize piping.

But plants with very high process steam demands will generate high-pressure steam in a central boiler room. Then this steam will be passed through a turbo-generator on the way to the process. Both Btu. and kilowatt requirements will be produced for virtually the cost of the steam alone. The generator, of course, will be tied into a public utility network for sale of excess power.

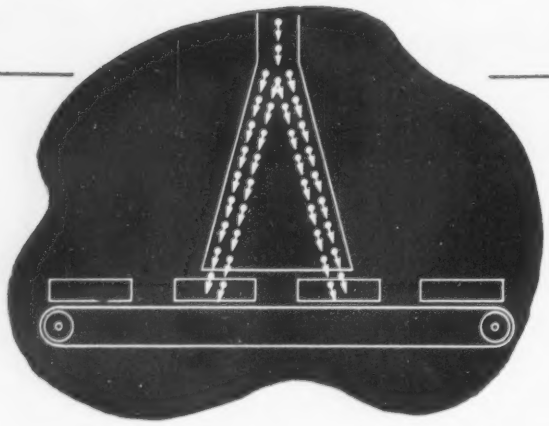
In most instances, however, electricity will be purchased. It will come to the plant at high voltage and will be stepped down in a packaged substation.

Many plants will have duplicate substation facilities with automatic switchover to avoid shutdown in event of outage. Others with large low-temperature rooms will install a standby engine-driven generator to keep compressors running in case of power failure.

Plant Personnel

Your average food plant worker in 1978 will be a highly intelligent individual capable of handling the complexities of the advanced operations.

His pay will be on a corresponding high level. The era of low pay for food plant workers, resulting in something less than a first-class work force, is fast going out.



COLD STERILIZATION

COLD STERILIZATION is a new approach to food sterilization. It involves ionizing radiation, specifically the beta or cathode rays and gamma or X-rays, to destroy food-spoilage organisms.

Foods treated with ionizing radiation are not as markedly altered as those that are cooked. In some instances, there are no noticeable changes. The process not only applies to the destruction of microorganisms but also to insects.

At this time, there is no commercial installation. Work so far has established some conditions required for sterilization. It also has uncovered problems yet to be solved, the most important involving prevention of an undesirable, scorched-like flavor, which usually accompanies irradiation. Development of this flavor probably is the greatest obstacle to the broad application of the process. Other changes noted were in color, odor, and texture.

Experiments have shown two general ways of deriving benefits from irradiation. First, complete sterilization can be secured by using the necessary amount of radiation, approximately 2 million rep. (roentgen equivalent physical). Ordinarily, the flavor of the food is significantly altered with this dosage.

Second, by using smaller quantities of radiation, a percentage of the organisms can be destroyed. In certain instances, the shelf-life of a food product can be extended in this way. Because of the reduced amount of radiation, flavor changes are less and, in some cases, foods of good acceptability can be produced.

It is possible that reduced radiation treatment, applied as a surface effect, may be the first successful application.

Units on Hand

Available types of radiation fall into two broad classifications—those from machine sources and those from radioactive fission products.

Cathode ray machines produce beams of electrons, which are negatively charged. And the electrons can be accelerated by positive voltage. The amount of acceleration usually is determined by the voltage used.

It appears that three types of accelerators—the electrostatic or Van de Graaff generator, resonant transformer, and Capacitron—have been developed to the point where they can be considered for irradiating foods. They avail up to 5 or 6 million volts.

A fourth unit—not developed to the point of these three—is the linear accelerator. It offers possibilities of considerably higher voltages.

Speed to which the electrons are accelerated is important since, for a given material, it determines the penetration by the electron beam. About 5 million volts penetrate an inch of water. Even with irradiation from two sides, cathode rays generated by standard available equipment cannot pierce more than about 2 in. of a food (meat, for example).

X-rays or gamma rays are very penetrating, thus overcoming this cathode ray deficiency. X-rays can be emitted from ordinary X-ray equipment. Such sources, however, suffer from the enormous inefficiency of X-ray generation. Only a few percent of the energy put into the tube emerges as X-rays.

Certain fission products, resulting from the formation of plutonium in reactors, emit gamma rays in the course of their radioactive decay.

Several schemes have been proposed for securing this radiation, including both the gross fuel material itself (in a convenient physical form) or the separated and purified radio-active elements. Considerable work must yet be done before such fission products are available even for experimental purposes. Experiments with gamma rays are being accomplished largely with artificially radio-active cobalt-60 obtained by exposing cobalt-59 to a (Turn to page 236)

Future Possibilities

What all this may mean to food industries today, of course, is a matter of conjecture. Canned foods might be expected to be remarkedly improved, since overcooking resulting from the heat processing needed to destroy spoilage organisms will be obviated. They probably would only be cooked to the degree determined by palatability considerations. Other food items now having relatively short periods of acceptable quality may have them extended. Meats, fruits, and vegetables might benefit in this way from radiation treatment.

Whether refrigeration requirements could be reduced or even eliminated is yet unknown and will depend upon the importance of factors of food deterioration not related to microbial action.

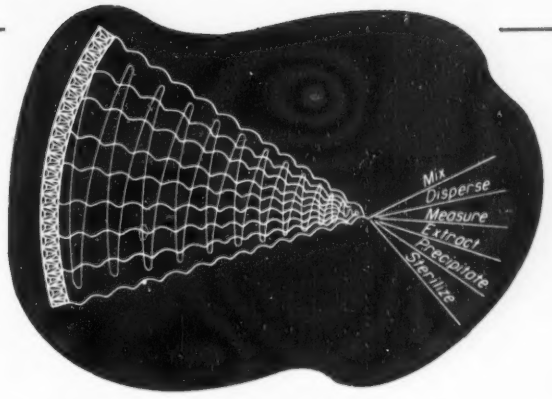
Packaging adapted to the needs of the specific food product undoubtedly will play an important role in the success of such applications.

Ionizing radiation may even be used to control insect infestation. Low doses needed make it attractive for this purpose. Such use, however, will be largely governed by relative costs of radiation and competitive processes.

All these possibilities rest heavily upon research yet to be done. Undoubtedly, as work continues, new possibilities will develop.

FOR THE FUTURE

ULTRASONIC PROCESSING



NOW MOVING from the laboratory to the food production line is ultrasonic energy.

It's already at work as an extractor in brew kettles—effecting substantial savings in hops. In other food plants it provides split-second measurement of viscosities of liquids, such as condensed milk, oils, and syrups.

In the lab, ultrasonics are doing the seemingly impossible, such as mixing oils and water. Following are other achievements proved in the food lab:

(1) Homogenizing and emulsifying (as with milk, peanut butter, baby foods, and chocolate). (2) Precipitating solids from liquids (as in clarifying fruit and vegetable juices, and separating starches from slurries). (3) Gaging liquid levels (in sealed containers of beverages, soups, etc.). (4) Catalyzing chemical reactions (fermentation, ageing of wines). (5) Cleaning metal parts (as degreasing of food processing equipment). (6) Inspecting pipelines for internal corrosion. (7) Collecting solids from fumes (recovery or anti-pollution).

Other products that may benefit from ultrasonic treatment are ice cream, mayonnaise, curd, marshmallow, and fondants. And in sugar refining, the vibrations greatly accelerate the rate of cyrstallization.

Because of its future possibilities in the food field, you should understand its fundamental principles and action.

What Is It?

Shout, and you create sonic energy—that is, energy in wave form, comprising alternate, regularly spaced compressions and rarefactions at frequencies as high as 20,000 cycles per second. Above this frequency, such energy becomes ultrasonic.

Ultrasonic waves are generated by a transducer, a device for converting electrical or mechanical energy to sonic energy. The waves are carried from the transducer to their point of application in a coupling medium, such as oil or water.

Transducers applicable to food operations are of these types: Magnetostrictive, piezoelectric, and mechanical vibrators. The latter works in the sonic range—under 20,000 cps. Operations of the first two carry beyond this range.

Magnetostrictive—Certain metals, when subjected to fluctuating magnetic fields, will alternately shrink and enlarge, setting up sonic and ultrasonic vibrations. The usual range is from 5,000 to 50,000 cps.

Piezoelectric—Crystals like quartz and barium titanate (ceramic radiators) elongate and shrink with the frequency of an applied alternating current. The crystals will generate a relatively high energy output, and the waves can be beamed in predetermined directions. Enormous energy can thus be concentrated in a limited area. For example, sound intensity of 65w. per sq. in. of radiating area can be attained.

Beamed at a frequency of 1,000 kc. into water, this energy will increase the pressure at the spot of *greatest compression* of the ultrasonic wave to approximately 78 psi. Then, on the same spot, one 2 millionth of a second later, the *greatest constriction* occurs with an equal and opposite tensile stress of 78 psi. Since the wave length of sound at this frequency in water is about 60 mils, this means a pressure gradient of about 5.2 psi. per mil. Any liquid exposed to the rhythm of double the frequency with such elevated differences of pressure will be influenced in some manner. Most liquids will break down during the dilution phase and "cavitation" will occur. Collapse of these cavities create tremendous pressures.

How It's Used

Gas dissolved in liquid will collect at pressure spots (or "cavities") and rise to the surface.

In homogenizing or emulsifying, the dispersing effect is due to the enormous forces of acceleration.

Ultrasonic energy also has been used as a physical catalyst to speed chemical reactions, such as wine ageing.

Gels can be converted into the liquid state.

Bitter substances are being extracted successfully from hops in the brew kettle, saving up to 40% in amount of hops required.

Finely dispersed floating particles can be made to coagulate and precipitate by the application of ultrasonics. This condition can be accomplished with liquids or gases.

Other observations reveal that bacteria in suspension can be precipitated and mechanically destroyed by the action of the waves. Ultrasonic devices for pasteurizing milk and sterilizing food are now in a state of evolution.

Mechanical—Generating energy over audible range, a small mechanical transducer recently was applied in mixing fine particle solids and liquids. Vibrations are created when a jet of the liquid impinges on a blade, which then vibrates at its natural frequency. Both jet nozzle and blade are enclosed in the resonant-bell energy concentrator.

Factors limiting the use of ultrasonics in high-volume processes are low energy efficiency, restricted area coverage, and high initial cost of equipment.

But as new uses unfold in the future, cost of this equipment will certainly drop, and its efficiency and range will unquestionably be improved by research. So ultrasonic energy will definitely find its place in the food plant of the future.

QUALITY CONTROL

Instruments . . . Ingredients

Points of progress are uses of improved instruments and methods in control of food quality.

"DOES IT come up to specs?"

This question surely would have startled the average food processor 25 years ago. But today it has become a universal query. Fact is, food manufacture has long since entered a new, more precise era.

Back in 1928, most processess were batch. So a 4-hr. moisture determination or 2-hr. titrations caused few plaintive howls from the production floor.

But there were signs that faster, more objective lab methods were needed to match accelerating production and greater federal control in the '30's.

In '28, for example, the Munsell System was developed for precise checking of product with color standards formulated by the Bureau of Agricultural Economics. Then color testing was boosted tremendously, in 1930, when the first basic photoelectric colorimeter was developed.

Advances in potentiometric measurement with new bridge-type electrical instruments paved the way to culling tedious comparative and titration procedures. The exacting glass electrode for direct pH evaluation was made feasible, and precise conductivity gaging of solutions appeared.

Use of an electrometric indicator in '34, for example, sped iodine titration of SO_2 and reduced a former end-point error from 0.21 ml. to 0.05 ml.

Other tests lost their tedium. The refractometer was used to pin-point solids in eggs. Refractive index also proved a quick end-point gage of Swift stability test on fats.

Polarigraphy was applied to measure dissolved oxygen in citrus juices, a former 3.0% accuracy being improved to 0.02. Another citrus speed-up was use of colorimetry to estimate bitterness-producing glucosides in preserves.

Chromatography was just appearing to solve problems in separation and estimation of sugar mixes. By selective adsorption of sugar fractions and redeposition, this technique trimmed a difficult analysis from hours to minutes.

Away From Chemical

By the mid-'30's, need for speed seemed to dominate laboratory thinking. And some basic developments accelerated this trend.

A quick moisture tester working on the resistance principle appeared in '34. This employed external hydraulic pressing of the sample between electrode plates—water content being a function of ability to pass current. Dry product moisture determinations were cut from hours down to 3 or 4 min.

In '35, Karl Fischer came up with his famous reagent for accurate titration of solutions for water content. Recent use of the Waring blendor and electrometric titration has increased the scope and speed of this determination.

In '37 the long-known principle of electrophoresis—variable migration of molecules in an electric field—was put to work in an instrument by Tiselius. Here's how the device is revolutionizing protein determinations: Proteinaceous materials are dissolved in a buffer in the lower half of a U-tube, then overlayed with pure buffer. Electrical potential applied to the protein-buffer interface causes a variable migration upward by different protein molecules. These are identified through parallel light illumination, which shows up the refractive index gradient.

Electrophoresis apparatus has become more usable with optical lenses and built-in photographic attachments. And recently an oscillograph has been integrated that permits actual viewing of wave structure changes when pipetting fractions from the sample.

A whole new field for optical measurement opened with the concept of spectrophotometry. Key was a technique for compactly turning white light into a spectrum by using an etched grating. Hence, it was possible for a small instrument to send this spectrum through a controlled slit that selected an appropriate monochromatic beam to pass through the liquid sample. Degree of absorption—definitely related to constituents in the sample—showed up through a photocell-indicator pick-up.

Initial use of visible light spectrophotometry was for

more accurate color blending and matching of food. But recently the device has tackled more complex jobs, such as relating certain chemical constituents to fruit maturity.

Preventive Control

The philosophy of "preventive quality control" was being accepted in the late '30's. And in '37 a simple new approach for quick-testing vegetable maturity prior to canning came up with the tenderometer. This was an assembly for measuring the force needed to shear a vegetable sample. Similar instruments appeared for gaging texture of various foods by shearing, penetrating, cutting, and pressing.

Other quick, objective inspection methods were developed to spot off-grade materials. In '38 an X-ray device was installed to locate subcutaneous dry rot in beets and hollow centers in potatoes. Photocells were employed to sort and determine refuse in other dry foods.

Refractometers were moved into the plant to detect end-point in preserve boiling—also for controlling sweetness of brine and pickling solutions. Viscosimeters were set up at the soup kettle, ketchup vat and mayonnaise cooker to check consistency. Color meters were operated at the grading bench to check incoming tomatoes. Babcock centrifuges for milk fat were relocated on the receiving platform.

Subjective Control

During the war the concept of "panels" for subjective food testing had advanced to high science at Seagram Laboratories with its "psychometric" system. Here, a selected group of trained tasters was created to score food quality factors under rigidly controlled conditions.

Psychometrics proved not only a precise, but quick way to quality evaluation—it also provided a working tool for pinpointing optimum procedure in formulating, blending, processing, and packaging.

With the war came food standards; faster, continuous processes; need for quicker, more precise food quality tests. And the food technologist came into the field as a quality control specialist. Now several universities are training technologists for the industry.

The Personnel "Tool"

Here are some contributions by technologists: In '51 a Kansas group came up with a rapid X-ray determination for infestation in cereal grains. Then a leading electronics company took over and commercialized this development.

During the same year at least three different locales studied color difference meters for evaluation of such products as whole tomato, tomato juice and ketchup. The new method has almost become standard among large tomato processors, and more functional color checking devices for this and other fruits have appeared.

And other developments portend similar gains in the future. In '51 a spectrophotometer with reflectance attachment was used to objectively evaluate green beans. A year later color deterioration due to heat was pinpointed with a color-difference meter. And now a photoelectric colorimeter bids fair to eliminate titration as a means to peroxide value determination in fats and oils.

The big trend today is toward objective instrument measurement—accenting improved speed, cost, precision.

Several new consistency meters are in tentative use. One device, especially for jams and preserves, lets the product spread down a slanted calibrated trough for a fixed time. Another employs a sample cup that rises off a concentrically scaled plate, spread in 30 sec. being the index here. Developed for cream-style corn, it also has been applied to applesauce and jellies.

Viscosity measurements display new capability. One motor-driven unit, which electronically measures torque of a rotating spindle, employs eight speeds to range over 0.5 to 2,000,000 centipoises. It has provided a real approach to gaging "finish" in tomato products.

Another viscosimeter consists of a simple probe utilizing ultrasonic vibrations, with an electronic computer converting its signal to calibrated measurements. It has been used as a quick check in production of syrups, vegetable oils, and emulsions.

Accuracy of pH Units Augmented

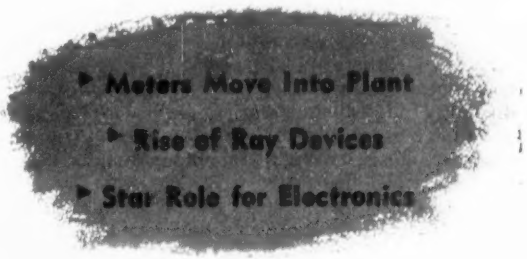
New glass electrodes have vastly extended the scope of pH equipment. And special pH probes have been developed for such solid products as cheese and meat. Greater accuracy and portability have been built into pH testing units. Electronic self-balancing systems have upped precision to as much as 0.03 pH. One recent battery powered unit weighs only 8 lb., yet will quick-check at spot locales with accuracy better than 0.1 pH and can be used for Karl Fischer titrations at the flick of a switch.

Subjective errors have been reduced by new automatic balances that can be knob-manipulated by unskilled personnel. One cereal company figures that the scales have cut weighing time from 3½ to ½ min.

At least 40 new quick-moisture testing systems have appeared. Most work on capacitance or resistance of foods as a function of water content. And several have displayed excellent accuracy on certain products. All have reduced a former, lab-bound tedious drying from hours to minutes.

Recently, an interesting compromise between dry-weigh accuracy and quick testing has appeared in the form of a combined over-torsion balance. Sample is placed directly on its scale tray and infra-red dried. A tri-scale vernier is adjusted as the sample loses weight and read when losses stop. Accuracy of this system has been found within 0.03 of standard oven tests for grain.

New vistas of polarigraphy are extending objective quality control. A continuous recording dropping-mercury electrode unit determines tast-influencing trace elements in minutes. It pinpoints ascorbic acid, replacing a chemical method involving several steps.



Oxygen content is being gaged with new, objective instruments. One continuous sampling device works on the unique paramagnetic quality of oxygen—its ability to pass magnetic lines of flux. Samples route through a suspended glass body that rotates with change in flux, transferring this motion to a calibrated scale. Another relies on loss of this paramagnetic property in oxygen with temperature increases, and it measures by the cooling effect of moving gas on a heated resistor in a Wheatstone bridge.

Ion exchange is offering potential as a laboratory control tool. Small exchange columns extract fatty and amino acids.

Optical Upheaval

A tremendous boost in the possibilities of objective instrumentation was provided by progress in optics during the war.

Ability of optically ground synthetic crystals to pass infra-red light was a clue to today's infra-red spectrophotometer. Unique absorbing properties that various food constituents exhibit in this light already have led to more rapid determination of rancidity in fat and impurities in butter.

Better lens-grinding techniques and anti-reflectance coatings have broadened microscopy. Take the polaroid microscope, which recently became available in a relatively inexpensive model with built-in illuminator and single focus. This instrument qualitatively and quantitatively analyzes dry mixtures of such materials as salt, starch, sugars, dry milk, wheat, and corn flours.

Another interesting microscopic achievement—the "phase" unit—is coming into its own. By superimposing a phase plate over the geographical image of the light source, this 'scope offers broad contrast viewing for faded objects, emulsions, and living tissues. These normally elude a bright light miscroscope.

And recently we have been introduced to the "3-D" or steremicroscope—combining magnification and stereopsis in a single operation.

Finally, there is the "giant" of microscopy, the electron microscope capable of 100,000X magnifications and true molecular visual studies. Some interesting studies of flour compressability and particle size have been made with it.

Better lens techniques have also improved other old standbys. Portable hand refractometers spot test preserves and citrus products in the plant with an accuracy better than 2% of scale span.

A development during the past year or two bears close watching. This is use of the echelle grating instead of diffraction grating in spectrophotometry.

Conventional grating to resolve light into spectra involves a ruled series of lines on aluminum-surfaced glass. The echelle is made of ultra-precise ridges machined directly into the glass surface, and it produces spectral detail normally requiring 3 to 6 times more instrument space.

Because replica echelles soon may be cheaply "pulled" from a master, this new optical element can provide ultra-precision at little extra cost.

A recent universal spectrophotometer can be switched to either photofluorometric or nephelometric measurements. These latter techniques have been useful in vitamin determinations and in accurate measurements of liquid haze by Tyndall light.

And the spectrophotometer has been augmented by an electronic scanning device that translates its analyses into dynamic curves.

Spectrophotometer in nephelometry was developed to count bacteria in drug ampules without opening them. It does this by measuring intensity of monochromatic light scattered by dispersed particles or suspended colloids. Food technologists have found it useful in determining the number of bacteria and other suspensions in water and beverages.

Here are other recent strides by spectrophotometry:

In '50 the AOCS (oil chemists) specified this instrument as the most practical way to measure optical density of oil.

In '52 the AACC (cereal chemists) adopted it for quickly counting insect fragments.

(Turn to page 288)

INGREDIENTS

During the past 25 years a wide variety of special "quality improving" ingredients have become available to the food processor. These products contribute greatly to the uniformity, flavor, palatability, appearance, keeping quality, and healthfulness of the foods in which they are incorporated.

Specifically, they are added to bring about one or more of the following benefits:

1. **Prevent spoilage**
2. **Compensate for deficiencies**
3. **Produce desirable changes**
4. **Prevent undesirable changes.**

Some of these ingredients act directly. Examples are: Bleaching of flour and vegetables, darkening of cocoa (Dutch process); elimination of deleterious microorganisms in doughs, fruits, and vegetables.

Others accomplish desired results by indirect means. Examples : Anti-oxidants that are added to lard to inhibit rancidity in fat-containing foods such as pre-mixes, potato chips, and doughnuts, and fungicidal agents applied to wrapping materials to prevent mold growth on foods packaged in them.

Few Used 25 Years Ago

Of course there were some ingredients used for these purposes prior to 1928. Pickling brines for preserving meats, and sulfur dioxide and sodium benzoate for preservation of fruits, fruit juices, and flavors; MSG to enhance the flavor of Chinese foods; fungal enzymes to improve bread dough; gelatin and gums to stabilize frozen desserts are a few examples.

But many of the products that play important roles today were unfamiliar in 1928 (see accompanying table). To name a few: Vitamins used in the fortification of foods, although known, were unavailable; and antioxidants that have made possible many of our present packaged foods were unknown.

Several patents were granted in '28 for increasing the vitamin D content of milk by irradiation. And in the early '30's cows were irradiated and fed yeast in an attempt to increase the vitamin D content of their milk. But it was not until 1932 that equipment became available for commercially irradiating pasteurized milk. Shortly thereafter, fortification of both pasteurized and evaporated milks by addition of cod liver oil was begun. This apparently marked the first direct addition of vitamins to foods.

Today, large quantities of milk are fortified with vitamin D, and some milk with as many as six vitamins, also margarine with A and D.

White flours, breads, farina, corn meal, corn grits, cooked cereals, macaroni and noodle products now contain specified vitamins and minerals, with vitamin D and calcium optional. Some rice is likewise fortified with vitamins and minerals.

Fruit and vegetable juices have, in some cases, added vitamin C.

And with the recent development of processes and facilities for large scale production of synthetic vitamin A, its addition to many foods is foreseen. Experimental results already indicate the feasibility of adding A to cookies, cakes, frostings, sauces, confections, peanut butter, frozen desserts, pediatric and geriatric products.

The list of major ingredients added to foods to improve quality, products to which they were added, and desired results (contained in the accompanying table), is indicative of the large increase in numbers of ingredients during the last quarter of a century.

Big Jump in Agents Added

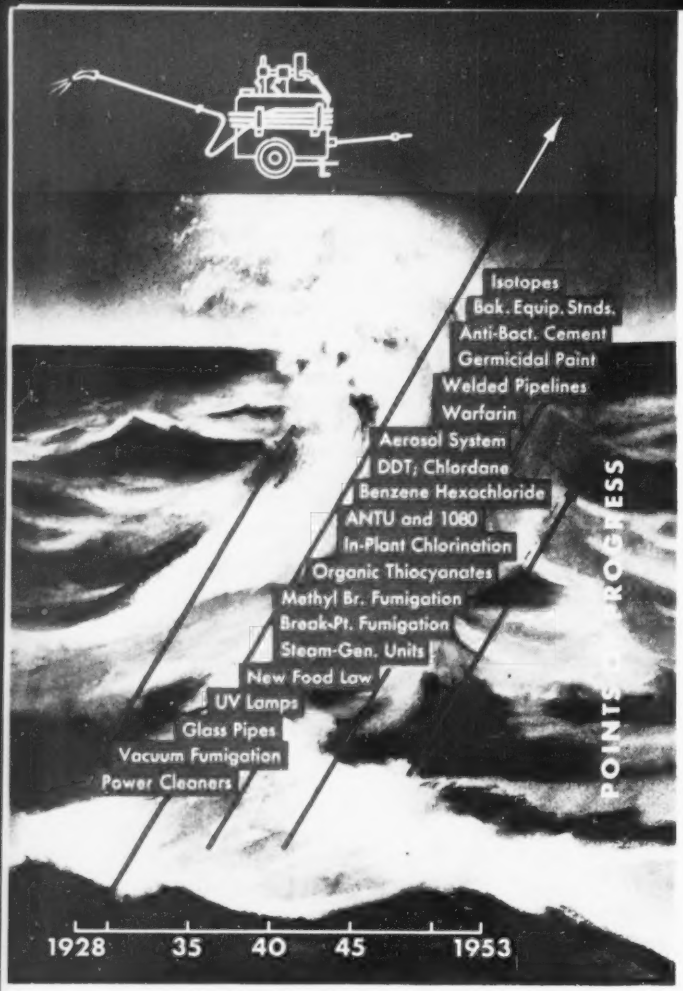
There is little doubt that the increasing knowledge of nutrition and chemical composition of foods, coupled with the enormous swing to packaging assures continued research pertaining to the problems associated with maintenance of quality.

And, although the present attitude of FDA toward additive ingredients has created uncertainties, the chemical industry is bound to introduce new products to meet proved needs of food companies.

On their part, food companies should provide properly trained personnel to evaluate their requirements, and to keep abreast of the new developments and their quality benefits.

Quality-Improving Additives: When . . . Into What . . . and Why

Product	First Used	Added to	Purpose
Alkalis	Pre- '28	Cocoa	Darken color (Dutch process)
Nitrous oxide, nitrosyl chloride	Pre- '28	Flour	Bleaching
Fungal enzymes	Pre- '28	Dough	Improve loaf volume, characteristics
Vinegar	Pre- '28	Dough	Prevent rope
Sulfur dioxide and sodium benzoate	Pre- '28	Fruits & flavors	Prevent bacterial growth
Sodium citrate	Pre- '28	Process cheese	Emulsification
Ethylene and acetylene	Pre- '28	Celery	Produce lighter color (blanching)
Monosodium glutimate	Pre- '28	Soups & sauces	Accentuate flavors
Pectin	Pre- '28	Jellies	Compensate for deficiencies in fruits
Acidifying agents	Pre- '28	Jellies, fruit butters	Compensate for deficiencies
Gelatin and gums	Pre- '28	Ice cream	Control crystal formation
Salt and spices	Pre- '28	Meats & vegetables	Preserve and flavor
Invertase	1929	Candy centers	Produce softening
Lecithin	1930	Chocolate coatings	Reduce viscosity, increase water absorption
Agar and dry skim milk	1930	Cream cheese	Improve body, handling
Enzymes	1931	Fruit juices	Clarification
Lecithin	1932	Candies	Emulsification of fat, antioxidant
Vitamin D	1933	Milk	Fortification
Yeast	1933	Egg White	Ferment reducing sugars
Mono- and diglycerides	1933	Vegetable shortenings	Improve cake qualities
Soya flour, crushed peanuts, sesame seeds, corn germ	1934	Lard	Prevent oxidation
Oat flour	1934	Fat containing foods	Prevent oxidation
Citric or other acids	1934	Hams	Speed curing action, preserve meats
Glycerine	1935	Coconut	Preservative
Sodium alginate	1935	Ice Cream	Stabilizer
Enzyme solution	1936	Beef carcasses	Speed tenderizing
Propionates	1936	Bread doughs	Control rope
Carbon dioxide	1936	Cream	Speed churning, extend butter's life
Hydrogen peroxide	1936	Cake batter	Improve texture
Buttermilk powder	1936	Rye bread dough	Improve flavor, appearance of bread
Lecithin plus glycerol monostearate	1937	Margarine	Prevent bleeding, spattering when frying
Aliphatic acid	1937	Bread	Inhibit mold growth.
Sodium benzoate	1937	Peeled potatoes	Prevent browning
Oat flour	1937	Parchment butter wrappers	Prevent mold growth
Oat flour	1937	Storage cream	Prevent oxidation
Vanadium salts	1938	Yeast	Catalyze growth
Phosphoric acid	1938	Animal and vegetable fats	Prevent oxidation
Nitrous oxide	1938	Whipping cream	Pressure whipping
Lactic acid	1938	Pork, pickles	Preservative
Calcium salts	1939	Canned tomatoes	Product firmness
Iron, calcium, phosphorus, vitamin B_1	1939	Cooked cereals	Fortification
Soy flour	1939	Bread dough	Retard staling
Calcium propionate	1939	Butter wrappers	Prevent molding
Ascorbic acid	1939	Frozen fruits	Prevent browning
Ascorbic acid	1939	Fatty foods	Prevent rancidity
Glycerine	1939	Peanut butter	Prevent fat separation
Ferrocyanide	1940	Fruit juices	Precipitate cloud
Citric or hydrochloric acid	1940	Peaches	Prevent browning when frozen
Gum guaiac	1940	Animal fat	Inhibit rancidity
Sodium nitrite	1940	Ice for fish	Prevent deterioration
Thioureau	1940	Cut fruits and vegetables	Prevent browning
Vitamins	1941	White bread	Fortification
6 Vitamins	1941	Milk	Fortification
Soybean extract	1941	Soybean oil	Prevent reversion and rancidity
Vitamins A & D	1941	Margarine	Fortification
Yeast	1941	Bread	Enrichment
Propylene glycol	1941	Shredded coconut	Preservative
Propionic acid	1941	Cheese	Inhibit mold growth
Demethylated pectin	1942	Fruit jellies and aspics	Reduction in sugar
Glyceryl monostearate	1942	Cake batter	Improve texture
Lecithin plus aluminum stearate	1942	Chocolate coatings	Reduction in viscosity
Gallic acid and ethyl gallate	1942	Animal fats	Antioxidants
Lecithin	1943	Bread and cakes	Aids antioxidants
Tocopherols	1943	Animal fats	Inhibit rancidity
Vegetable shortening	1943	Animal fats	Inhibit rancidity
Wheat germ oil, citric acid	1943	Animal fats	Inhibit rancidity
Gum guaiac plus citric or phosphoric acid	1943	Animal fats	Inhibit rancidity
Pectinates	1944	Frozen fruits	Reduce juice leakage
Lard	1944	Frozen meats	Prevent freezer burn
Sulfurous acid, sodium sulfite dip	1944	Sliced apple	Firming
Vitamins B_1, B_2, niacin	1944	Macaroni products	Fortification
Vitamins B_1, B_2 niacin	2945	Candy	Fortification
Propylene glycol	1945	Fruit juices	Preservative
Lecithin	1945	Macaroni products	Improve handling, cooking
NGDA, propyl gallate, citric acid	1945	Vegetable fats	Prevent oxidation
Edible oil, NDGA, benzoate	1945	Fatty fish	Coating to prevent oxidation
Ascorbic and citrus acids	1946	Fruits	Prevent browning
Oil seeds, cereals, legumes	1946	Candies	Increase fat, carbohydrates, minerals, vitamins
Carbohydrates	1947	Egg Whites	Protects during drying and storage
Sorbitol anhydride esters	1947	Cake batters	Emulsifying and whipping agents
Superglycerinated fat	1947	Animal shortening	Retard staling of bread
Glyceryl monostearate	1947	Bread dough	Retards staling
Glyceryl monostearate	1948	Ice cream	Emulsification
Soybean flour	1948	Pie crust	Inhibit rancidity
S. Lactis	1948	Egg white	Ferment sugars prior to drying
Chlorine dioxide	1948	Wheat flour	Bleaching agent
BHA, propyl gallate, citric acid	1948	Animal fats	Inhibit rancidity
Vitamin solution	1948	White rice	Enrichment
Ascorbic acid	1948	Apple pomace	Improve color of juice
Antioxidants	1948	Packaging materials	Inhibit rancidity
Phytates	1949	Maraschino cherries	Prevent discoloration
Benzoic or acetic acid	1949	Freeze immersion solution	Inhibit mold growth
Beta-mercaptopropionic compound	1949	Vegetable oils	Remove trace, metals
Acetic acid, salt bath	1949	Potatoes and fruits	Prevent discoloration
Phytates	1949	Vinegar	Remove heavy metals
Sodium bisulfite	1949	Frozen apple slices	Prevent discoloration
Lignin and protinaceous matter	1949	Beer	Remove turbidity
Antibiotics	1950	Canned vegetables	Inhibit bacteria
Calcium lactate	1950	Apple slices	Firming agent
Monochloramine or dichloramine	1951	Wheat flour	Aging
Solution pectinate and calcium	1951	Fruit slices	Firming
Dry antioxidants	1951	Nuts and potato chips	Retard rancidity
Glucose oxidase	1951	Egg white	Eliminate sugars prior to drying
Sorbitol derivatives	1951	Chocolate coatings	Prevent bloom
Hydrogen peroxide	1952	Swiss cheese milk	Eliminate harmful bacteria
Sodium methoxide	1952	Lard	Improves plasticity
Fesaler compound	1952	Wine	Precipitate heavy metals
Sorbic acid	1953	Cheese wrappers	Inhibit mold growth
Soybean fractions	1953	Dough	Retards bread staling
Ascorbic acid	1953	Meat Products	Stabilize color



Points of progress are new, more efficient insecticides, rodenticides, sanitary units, and cleaning methods.

SANITATION

ADVANCES in food-plant sanitation in the past 25 years have been truly spectacular.

Sanitation in the food plant of '28 was almost wholly unorganized and attended with many material handicaps. Exceptions to this situation existed, of course, in the dairy and meat fields, where other laws and codes (federal, state, or local) provided actual regulation of sanitary conditions through some form of inspection.

Scientific Revolution

The revolution which has taken place in sanitation seems to have been forced by accumulated scientific and technological developments which were just being adapted to food processing in '28.

Stainless steel and Monel metal had been available, but as yet they had found little application in the food industry. Their introduction came by way of the milk field. Where handling of corrosive foods was involved, dependence was mostly placed upon wood or base metal coated with relatively unreactive materials such as tin or silver. Copper, of course, was used quite extensively. Glass-lined equipment had been employed for a considerable time.

Industrial vacuum cleaners and mechanical floor scrubbers had been introduced into other industries, but their application had not spread to food plants. Hypochlorites were in use to a limited extent. Oil flotation of insects and insect fragments, as a means of separation from foods, was developed at about this time.

There was, by '29, widespread recognition of possible benefits of chlorine for control of microorganisms. However, the methods and means of application were usually inadequate and, for the most part, chlorine was looked upon as a substitute where steam could not be applied.

What might be thought the first great step toward checking insects and rodents occurred about 1930 with the introduction of organic thiocyanates. But, these materials did not assume immediate importance because of available supplies of the old botanicals (flowers of pyrethrum, rotenone, derris, and cube).

Use of hydrocyanic gas in vacuum-chamber fumigation constituted a forward step in the destruction of insects in raw materials. Carbon disulfide was widely used as a highly efficacious (but dangerous) space fumigant, particularly for control of insects in grains.

In 1931, experiments were underway using ultraviolet rays to kill microorganisms. By this year, a few plants boasted using filtered air in some processing areas.

In 1933, work began on a proposed sanitary code covering general industrial sanitation and special problems of the food industry. It was sponsored by the U. S. Public Health Service and prepared under American Standards Assn. procedures.

One major development in '34 was a patent on softening water by dissolving sodium phosphate glasses to form soluble complexes of phosphate and metal ions. Also, the Rideal-Walker technique was developed for determinating the phenol coefficient of disinfectants.

"Quats" and U-V Lamps Appear

First reports appeared in '35 on the bactericidal activity of cationic detergents (quaternaries). In this year, there was developed considerable interest in the use of glass pipelines for milk and other food plants.

As a tool for destruction of microorganisms, ultraviolet light had now passed the experimental stage. It found wide application in meat-storage rooms and bakeries in '36 and '37, and later in other types of plants.

Considerable progress was made in '39 on the application of synthetic wetting and surface-active agents, which were later to solve food-plant cleaning problems. Benefits of employing a chlorine rinse on milk-handling equipment prior to its use were recognized.

But the big news was the initiation under the Food, Drug & Cosmetic Act of plant inspections, wherein particular attention was given to sanitation. Some of the earliest checks revealed many opportunities for product contamination by rodents and insects.

The year 1940 is notable for new developments in materials and equipment relating to sanitation, as well as new industrial applications of scientific discoveries and data. High-temperature short-time pasteurization was employed. Other equipment developments included the use of steam-lift guns for cleaning purposes and the portable steam-generating unit.

Experimental work on chlorine disinfection set forth the theory of break-point chlorination. Methyl bromide

was tested as a fumigant. This led to its general use for space and spot fumigation. Synthetic resins were used as acid and base exchange compounds—a development destined to have an important effect on water treatment. Tests with the quaternary-type compounds were carried on. Gluconic and other organic acids were used for equipment cleaning to remove milkstone.

Probably 1941 should be credited with the application of ultraviolet control of microorganisms in breweries. And during that year high-temperature short-time pasteurization processes were used, experimentally at least, in the production of tomato juice. Experiments were carried out with chlorinated paints in an attempt to check microorganisms. These paints were not so successful but represented the start of intensive work in this field.

Because of the shortage of man power during World War II, there was a growing call to increase efficiency through industrial engineering. Due to the shortage of conventional materials, the development of new ones and new applications were greatly hastened. As the availability of the botanical insecticides became limited, organic thiocyanates were put into extensive use.

Better Insecticides Come

Methyl bromide became a widely accepted fumigant and was employed in treating materials under tarpaulins—a technique that provided both economy and convenience. Information on surface-active agents was steadily increasing, with much interest in non-ionics. Bulk storage of flour, which offered sanitation advantages, was coming into use.

In 1944, the armed forces made widespread use of DDT. However, it was not possible for industry to use residual insecticides of this type until after the war. Other important discoveries were being made in this field of insecticides. Information was steadily being obtained on the chemical structure of pyrethrins—the active elements of pyrethrum.

In 1945, two new rodenticides, ANTU and 1080, made their appearance. Up to this time, dependence had been primarily placed upon red squill, barium carbonate, and arsenic compounds. While these new substances had definite limitations—ANTU because of establishment of tolerance and 1080 because of extreme toxicity—they solved many problems previously presenting serious difficulties.

From a plant-engineering standpoint, an important development was application of in-plant chlorination. Quaternary ammonium compounds were being widely tried in plant equipment-sanitizing jobs.

By 1946, a new concept burst forth—building sanitation into food-processing equipment. Responsible were increased recognition of the need for higher sanitation standards and the desire for greater efficiency and lower labor cost in cleaning operations. Cooperation between food processors and regulatory agencies also fostered better sanitation.

Throughout the industry, some equipment had passed the point of repair because the war. And other equipment became obsolete. So, food-plant engineers and equipment manufacturers redesigned food-processing machines, making them more sanitary. Credit must also go to public health and regulatory officials.

Two new insecticides of great importance were introduced—benzene hexachloride (BHC) and chlordane for the control of roaches.

Space-spraying food plant areas, such as warehouses, with aerosols released from jets piped throughout the area, became popular.

Black light, in the lower range of the ultraviolet spectrum, began to be widely used to detect urine stains on food packages as an index of rodent contamination.

Applications of mechanized cleaning techniques spread. These included built-in and portable vacuum-cleaning equipment, power scrubbers, and mechanized sweepers. Principles of industrial engineering were more widely applied, with study, analysis, and improvement of methods. Plastic pipes and tubing, inert to most food substances, became available.

Use of liquid sugar expanded, with attendant reduction of contamination hazards, where proper safeguards were engineered into the system.

There was increasing use of positive atmospheric pressure within plant areas (or entire plants), where it was especially important to prevent product contamination.

1947 brought the use of synergists, which in themselves had little or no insecticidal effect but which multiplied the effectiveness of other insecticides—notably pyrethrins.

Effectiveness of cleaning compounds continued to increase with new knowledge and use of wetting, sequestering, deflocculating, and corrosion-inhibiting agents.

Remotely controlled doors became practical. They checked flying insects by making it possible to keep large shipping doors closed, except when traffic was passing through.

Sanitary fittings, making possible rapid dismantling and complete surface-accessibility of pipelines, had long been in use. Their employment spread from dairies to other food plants.

In-Place Cleaning Techniques

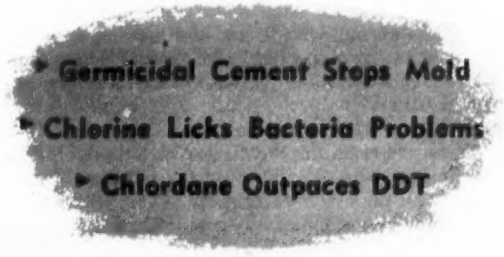
In 1948, a turn of the tide saw cleaning-in-place methods begin to gain favor. Practicability of such procedures was attributable to the development of detergents that could adequately remove food soils with the aid of the mechanical agitation provided by circulating the solutions through pipelines.

Organic acid cleaners prevented build-up of bacteria-harboring milkstone deposits. Adequate sequestration of calcium and magnesium, good deflocculation, and wetting action were also demanded of the detergent.

Advantages stimulating the use of this technique were: (1) Reduced time in dismantling and re-assembling pipelines, (2) elimination of the need for replacing expensive pipes and fittings unavoidably damaged by dismantling, and (3) curbing of line recontamination that frequently occurred when disassembled piping was left on racks.

Warfarin ("compound 42"), probably the most important chemical currently used for rodent control, made its appearance in 1949. Because of its action-mechanism, the readily identified symptoms of intoxication, the availability of antidote, and its effectiveness, it became an important and welcome agent.

In 1949, silicone coatings were used on surfaces such as bread pans and pastry sheets. They eliminated pan greasing, an operation difficult to control from a sanitation viewpoint.



Hot Spray Cuts Tank-Cleaning Time 75%

Vinyl plastic coatings simplified the handling of corrosive foods and promoted sanitation because of smooth, readily cleaned surfaces. Polyethylene pipes and fittings present similar sanitation advantages, including absence of taste and odor.

Flour was transported in less than carload lots—as in portable bin units—to offer sanitary and monetary advantages. Pneumatic systems for cleaner and faster handling appeared in new and remodeled bakeries. Not only did they eliminate lodgment of flour in dead spaces, but also destroyed insects and their eggs as a result of the impact produced by high velocity movement.

The year 1950 brought extensive use of welded, smooth, crevice-free stainless pipe, a distinct asset to cleaned-in-place installations. It also saw the application, on a commercial basis, of aseptic canning, which provided better sanitation and savings in materials handling.

Electrostatic separation was applied to remove filth (including rodent pellets) from grains, with greater efficiency than had been previously practical.

Anti-Bacterial Paints and Cements

With the utilization in 1951 of solubilized copper-8 quinolinolate ("Cunilate"), a new and important weapon was introduced for combatting mold and other microorganisms through inhibiting-type paints.

FDA, in 1951, announced a program for the control of grain shipments containing hidden infestation—weevil life within the grain kernels. Several laboratory methods for detection of infested kernels were evolved, but most appeared impractical. A tool that has so far proved practical is the X-ray.

Anti-bacterial cement was put into commercial use in 1951. It reduced floor deterioration caused by bacteria-promoted formation of organic acids. And it has presently checked mold growth for two years.

What appeared at first to be a serious setback in the progress toward better sanitation occurred in 1951 and 1952. Since the end of World War II, success of residual insecticides in pest control had been spectacular. True, DDT had been removed from use about dairies and dairy herds when it was found to be concentrating in fats and carrying through to the milk. But real consternation came when studies verified resistive strains of insects previously considered wholly controllable by DDT. The same was true with chlordane, lindane, and others.

Importance of this discovery, perhaps, is two-fold. First, there is not, as we had almost come to believe, an easy way to control insects. Control must still be sought, by eliminating conditions favoring insects. Second, we must attack the insect at the weakest stages of his life cycle (a problem for the entomologist), reduce resistivity effects (a problem for sanitarians and pest control operators), and search for new agents of relative safety to man but toxic to insects (a problem for researchers).

Organic phosphates have found important application in field-crop dusting. Some are now finding limited use for fly control in dairies and other plants. These organic phosphates present definite hazards, which are now receiving careful study.

In 1952, a new anti-coagulant for rodent control (Pival) was extensively tested by the U. S. Fish & Wildlife laboratories. It is now in limited commercial use and promises to become an important rodenticide.

Cleaning time in dairies was cut 75%, materials almost as much, when hot detergent solutions were applied with a pressure-spray unit that has eliminated hand brushing.

A development of great importance came in 1952 when the Baking Industry Sanitation Standards Committee established appropriate sanitation standards for equipment.

Widespread was use of a bulk-handling system for flour employing railroad cars and trucks. Flour is "fluidized" by mixing with air at a slight increase in pressure—a procedure that permitted elevation of flour through pipes to in-plant bins at considerable height above the car or truck. Handling in this way is in a closed-system, so as to reduce contamination.

Important, too, is application of radioactive isotopes. Entomologists and public health workers have, since 1951 profitably used them for tagging insects to study their habits and to devise control methods. Bacteria have also been tagged with radioisotopes for simple quantative measurement. Possibilities suggested are staggering.

About the Future

Past events and developments indicate that we are riding into the future on a tidal wave of advancement in food-plant sanitation. There is no evidence that the wave has crested or, indeed, that the rate of advancement has slowed down.

Speculation as to future developments is fascinating. It is easy to foresee many benefits at an early date through such efforts as those of the National Sanitation Foundation and cooperative sanitation committees like the Baking Industry Sanitation Standards Committee. Progress made in 1953 through the joint efforts of the poultry industry and the U. S. Public Health Service, working on a model sanitation code, forecasts similar programs elsewhere.

During the current year, the development of a continuous bread-making process foretells the eventual obsolescence of many sanitation problems in that industry. Reduced exposure of raw and in-process materials to contact by employees, and their handling in a closed system, will bring about closer sanitation control. For economic reasons, alone, this is an inescapable trend.

Likelihood of increased use of cleaned-in-place piping and process units seems self-evident. Along with this—and again because of the availability of efficient detergent compounds—it would seem that cleaning by sparger will become more common.

Ultrasonic mixing will simplify cleaning and sanitizing through elimination of moving parts and packing glands as customarily found in mixing equipment. Further, there should be opportunities to use ultrasonics for hydraulic-mechanical cleaning action with detergent solutions.

One thing is certain: To a much greater extent, industrial engineering methods and cost accounting will be focused on food-plant sanitation. Management will more fully recognize the need for assigning specialists to systematize the sanitation program for measurable results and controlled costs.

Every food processor must fix sanitation responsibility under competent guidance. If the operation permits, there should be a fully trained sanitarian or staff. If not, an alert individual should have the responsibility for follow-through, and a management committee should set standards. Advantage should be taken of the sanitation education and information programs of trade associations. And as with any other important management function, the services of a competent outside consultant fills a definite need.

This article was written by KEITH FITCH, specially for the Anniversary Issue, at the request of the Editors. The author is Executive Director of the Orkin Institute of Industrial Sanitation, Atlanta, Ga.

MATERIALS HANDLING

Points of progress are applications of unit loads and bulk materials handling.

ONE OF THE GREATEST expedients in cuting costs and increasing output in the food industry over the past 25 years has been improved materials handling.

A quick look back over your own working methods of these years will show how advanced means of handling have made your operations safer, easier, and more efficient. Check your plant's output per worker against the 1928 figure. It will tell a most revealing story.

But, don't stop at that. Many other benefits have been gained—smoothness of product flow, faster processing cycles, lower inventories, greater utilization of space, speedier movement of incoming and outgoing goods, easier and safer working conditions, better sanitation, higher quality, and less loss of materials and products.

Here's a quick spot-check on typical practices in 1928:

Bakers moved incoming raws—flour, sugar, shortening—from carrier to storage almost entirely by hand. Then, too, considerable manpower was expended on in-process transfers. Finished goods were generally transported in the same manner as the incoming raws—annually.

Canners employed the same techniques on incoming raws. The only difference was in type of container. Instead of bags, they used individual crates, baskets, or boxes. In-plant transfers and movement of finished goods also entailed considerable muscle power.

Likewise confectioners in '28 received their ingredients—sugar, chocolate, milk solids—in a manner which necessitated manual handling. The same was true of most processing operations and movements of outgoing candies.

Grain-products firms were about the only processors employing extensive electro-mechanical movers for incoming ingredients.

A good strong back was very much in demand in 1928 but even then it was relatively expensive. And today, muscle power costs about $10 per horse-power hour. The equivalent electrical energy for a mechanical handling system is available today for 3¢. That's 1/3,000th of the cost of muscle power!

Leads the Parade

Undoubtedly, the greatest impact on materials handling in the food field, over the past quarter century, has been made by application of the unit load techniques—the use of industrial trucks and pallets.

Development of the industrial power truck as a prime mover brought the application of this principle to the fore in our manufacturing industries. A railroad station in Philadelphia is generally regarded as the birthplace of the industrial truck. The year: 1906.

Forks trucks were developed in the early '20's to lift loads straight up and down. But it was soon apparent that loads could be carried more safely if the forks could be tilted back, and unloaded more easily if they could be tilted forward. So the tilting fork was developed in the late '20's.

During the early '30's, industrial developments were relatively slow. Then World War II brought industrial trucks into great demand. In the mid-40's the telescopic lift, permitting greater stacking heights, with low traveling clearance, came into prominence. This advance effected great economy in utilization of space and again extended the use of these movers.

Since the war, there have been developed numerous multi-purpose accessories greatly increasing the truck's versatility. Rams, booms, crane attachments, scoops, and many other special devices, permit handling of materials that do not lend themselves to palletizing. Push, pull and clamping devices eliminate the need of pallets in some applications. Other attachments permit the forks to be rotated and thus used for dumping purposes.

Postwar designs also have increased the trucks maneuverability, they were aimed at easier operation, smoother running and lifting, and compactness. Reduced turning radii allow operation of these trucks in confined spaces, such as inside box cars and highway trucks and within narrow aisles.

Because of its maneuverability and flexibility, the modern lift truck also plays a major role in today's maintenance picture.

More than 100 industrial trucks are used in single food plants. And the following applications indicate the versatility and economy of these movers.

In a fish plant, cost of materials handling have been reduced from $4.36 to $2.22 per 100 cases. Savings in

▸ Devices Zip-Up Efficiency

▸ Operating Requisites—Unit Loads

▸ Old 85-Hr. Job Cut to 1½ Hr.

the first 17 months of operation amounted to $27,000 on a $13,000 investment put in new unit-load equipment.

Formerly, unloading of a 30,000-lb. car of incoming materials required four men in the freight car, four men hauling hand trucks, one weigher, and six men in the refrigerator stacking fish. It took a full day to unload the car.

Today, the same work is done in a half day, with four men in the car loading pallets, one man on the power truck, and one weigher. No stackers are required in the refrigerator—the truck does the job quickly, easily.

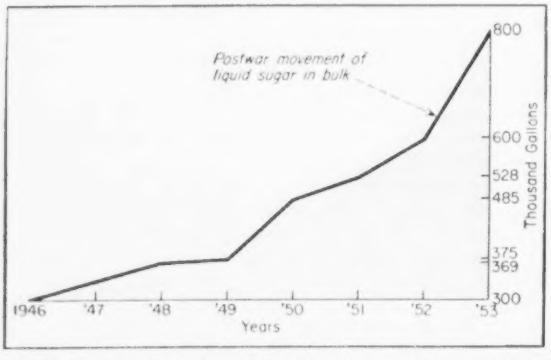
Having piled the fish in the refrigerator, before skinning, it is necessary to remove skin and bone, and then replace the fish in the cooler.

Under the former method it required the handling of whole fish from the floor stacks onto trucks, hauling to skinning benches, skinning into barrels, towing the barrels back to the refrigerator, unloading barrels onto the floor, and restacking to the ceiling.

Most of this work was done by professional skinners. These men spent, on the average, 4 hr. of a 9-hr. day handling materials instead of skinning fish.

Now a fish skinner takes a powered hand truck, and within 5 min. he has his pallet load of whole fish at his side ready to work. He throws finished pieces into a pallet box, which is returned to storage in the refrigerator. Instead of spending 4 hr. a day in materials handling, he now does this same work in 30 min. This is a saving of 3.5 hr. per day per man. Employing six such men steadily, 21 hr. per day are saved.

At the plant of a prominent canner, use of industrial lift trucks and palletizing has meant maximum warehouse space utilized, damage to cases minimized, and handling time and labor per case greatly reduced. When the old method was in operation, it was possible to load out from the shipping docks 10,000 to 11,000 cases per day. Now with the trucks, 50,000 cases can be handled per day from the same docks.



INDICATIVE of trend to bulk is the upsurge (above) of liquid sugar supplied by one company to food processors.

In the old way, a warehouse of 150,000-case capacity required more than three days to fill or empty, using a stacking elevator and 15 to 16 hand stackers. But now, less than three days are needed for one lift truck to fill or empty the warehouse. And with the help of two warehousemen, the outgoing cases can be loaded onto a trailer at the same time.

Through use of modern telescopic lift trucks, another prominent food processor has greatly reduced materials handling costs. Products produced in this plant are ingredients for bakeries, confectioners, ice cream makers, and the fountain trade. His own raws are such items as sacked sugar, cocoa, coconut, vanilla beans. In his method of operation, these raws must be delivered to the processing area on the second floor. The trucks (162-in. lift) have eliminated the need of elevators. Products are now delivered directly from one floor to another on pallets.

Formerly, 52 employees were required for the movement of materials. Now an increased volume (more than 250 tons in and out per day) is easily handled by 31 employees. There has also been a saving in space, since the operations are now handled in 5% less floor area.

Tied-In Movers Do the Trick

Key to efficient materials handling today is integration of various types of handlers available. Typical example is a recently completed plant in the Southeast. Here, receipt of incoming material in bags and drums is a necessity. Bagged dry ingredients are unloaded onto pallets, then moved by lift truck directly to a central feed-in point. Material is dumped from bags into a continuous conveyor system that delivers it to the ingredient storage bins. Drums are also handled by lift truck and dumped at a central point, and the liquid is pumped to tanks ready for use in the product.

Highly efficient units developed since the war to supplement use of lift trucks have upped efficiency of this unit-load system even further.

Outstanding among them are automatic palletizers. These receive cases or boxes direct from continuous conveyors and stack the cases into pre-established load patterns on pallets, the pallets themselves being automatically handled. Only manual effort required is to push a button.

Tremendous advances in the handling of finished case goods are being achieved in chocolate plants, breweries, soft drink plants, cereal products plants, and canning and sugar factories. Benefit: High speed, accurate palletizing at the rate of 1,800 cases per hr. They can load either the same or vari-size cases delivered by separate conveyors fed from a different filling and closing line resulting in a reduction in labor and savings in dollars. They also will handle large bags.

Another recent unit similar to the palletizer is the automatic stacker. In a Western dairy this robot stacks milk cases five high and transfers them to in-floor chain conveyors that take the stacks to shipping docks or cooler.

In the old system, cases weighing 72 lb. each were stacked five high by hand. Fatigued by this back-breaking job, the men were prone to handle the cases roughly, resulting in leaky milk containers. It was practically impossible to provide a continuous flow of filled cases to the trucks. And interruption in truck loading necessitated stopping the short lines to the truck dock, thus creating a bottleneck.

Major reason for mechanizing was to streamline production. The stacker relieved 8 men in two shifts, saving $40,000 per year. Bottling efficiency in terms of units per man hour is estimated to be upped about 10%. And last but not least, employees are happy to be rid of a tough, tiring task.

Then, too, at the other end of the process line—receiving—efficient new units augment the lift truck. Empty cans can now be delivered on pallet loads. Units have been devised that automatically remove the cans, through the use of magnetic force, from the pallets, transfer them to an unscrambler, from where they move in single file to the conveyor leading to the filler.

Machines have been developed that automatically remove empty cans from cases through the use of magnetic force, depositing the cans on one conveyor line leading to the filler. Empty cases continue on a second mover, which in turn takes these to the other side of the process line. Here, other automatic units—case loaders, place the then filled cans in the cases.

Magnetic can handlers also palletize unlabeled filling cans for warehousing, then take them off the pallets later for labeling. Retort baskets also are loaded and unloaded a layer at a time by magnetic units, as well as by hydraulic lifts.

Mechanical units have been developed to automatically remove bottles from cases and place the bottles on movers going to the washer. Case loaders are also in operation handling the filled bottles. These integrating units cut handling costs tremendously.

Many dry ingredients, such as flour, sugar, powdered milk, cocoa, and salt now come to the various food processing plants in bulk bins. These are built in two sizes (1,500-to-2,500 lb., and 3,000-to-4,000 lb. capacity). Bins are filled through round holes at the tops and discharge through hinged doors at bottoms of front sides.

Lift trucks move the bins directly to location on the process line. The bins proper act as storage hoppers in the process. Empties are also handled by industrial truck. Their use has brought lower costs by eliminating bags and manual handling, by improved sanitation and by less material loss.

Advantages in Bulk

New giant collapsible cardboard containers, holding 2,000 lb. of material, are used in a similar manner. For the miller, equipment is now available to fill these containers rapidly and accurately. A two-man crew can turn out a fully packed 1-ton box every 3 min.—20 tons per hr. Units of the type described above extend the advantages of bulk handling to the smaller and intermediate size plants.

The best way to save on incoming materials is to buy in car or truck-load quantities and handle by bulk conveyors.

In some of the newer bakeries, manual handling of all the major materials is eliminated. Flour, sugar, oils, and shortening are delivered to the plant in bulk, by tank cars or trucks for the liquid product, bulk cars or trucks for the solids. A pneumatic system delivers the solids to storage bins, and in turn to the supply hoppers directly above the mixers. Handling of liquids is simplicity itself—pumps do the job.

The system has the added advantages of better sanitation.

Operating figures from one of the country's leading bakers reveal these startling facts on the handling of flour:

With pneumatic conveyor (railroad car to storage bins) and electro-mechanical, sanitary screw (bin to mixer) movers, it requires 1½ operating hours to move a given amount of flour from the railroad dock to a point just ahead of the mixer.

In 1928, to move an equal amount of flour between the same two points (car to mixer)—and accomplish all the necessary intermediate tasks, such as rehandling of flour, dumping, cleaning of bags, etc.,—required 80 to 85 hr.

Actually the amount of flour moved in the 1½ hr. in the 1953 plant can be doubled, because the plant is equipped with dual unloading systems. And both are operated from a single board by one man.

But much more is gained than reduced operating hours. The comparison in sanitary conditions between the two plants is equally amazing. Today's plant is marked by its absence of dust. Further the incoming pneumatic mover not only is self-cleaning, but minimizes infestation. Its action tends to destroy any larvae in the flow. Maintenance is reduced too, and back-breaking hernia jobs are abolished.

(*Turn to page 238*)

Materials Handling of Tomorrow

Looking in the direction of 1978, we see a food plant of the future that will have even more thoroughly mechanized handling. This will be brought about by the integration of conveyors through the use of automation.

The several types of movers required for various phases of the operation will be tied together. Automatic transfer devices will take material from one to the next without manual handling at any point.

Processing speeds will then go much beyond today's marks. Number of items produced per employee will be greatly increased. Tasks will be simpler and safer. Sanitation and product quality will surpass present standards.

More efficient materials handling offers several outstanding opportunities for the future: (1) Lower labor costs in receiving, warehousing, in-process, and shipping. (2) Reduced factory space and building-size requirements, as well as lower in-plant inventories. (3) Easier and more attractive jobs for employees, a problem faced in many types of food plants. (4) Increased safety—contributing both humane and financial benefits.

Industrial surveys show that 30 to 35% of today's operating payroll in the manufacturing industries is expended on the handling of materials. That's $1 in every $3. And it presents a real cost cutting opportunity.

And here's another challenge: Almost one-third of on-the-job accidents suffered by American industry last year was traced to worker's over-ambitious attempts to handle heavy objects. Worse, the food industry has an accident frequency rate of 14.27 against an all-industry average of 8.40.

Handlers Play Major Role

Since they will integrate the steps of future continuous processes, handling methods will play an important role in progress and in large measure will dictate plant design and layout.

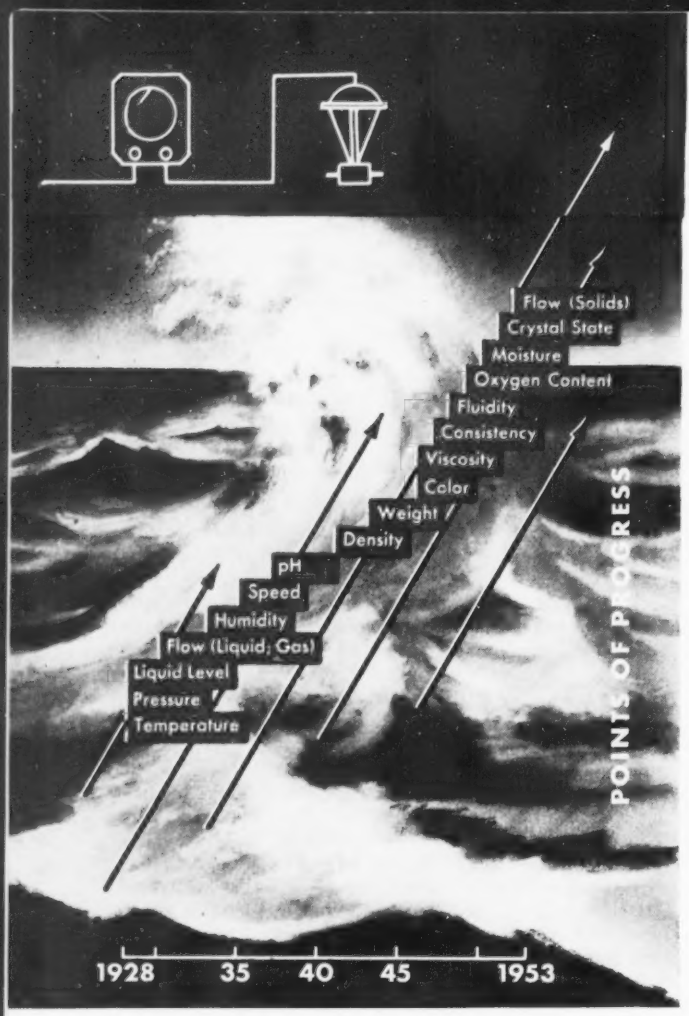
For all of these vital reasons, every food plant of any size must have someone who keeps abreast of developments and opportunities. And this person—either on his own or in cooperation with outside experts—will regularly study time, motions, space, dollars, and hazards involved in moving things into, through, and out of the plant.

No food plant can afford not to do this. Its competitors will have it over a product-cost barrel if it doesn't.

Leaders are showing the way. Others must follow.

After all, food manufacturing and processing is basically the movement of materials and products from point to point so that operations may be performed on these materials or products. Processing and motion are inseparable.

Today's Price Tags: Muscle $10, Power 3¢



Points of progress are process variables controlled.

AUTOMATIC CONTROL

FIVE BASIC FACTORS are needed to be in the food processing business: Plant, Equipment, Materials, Labor, Power. In the past decade, however, many hard-pressed food processors have begun to acknowledge a sixth basic and necessary factor—automation, or automatic control.

Why does this relatively new technology assume the importance of a "sixth force" for survival in today's food economy?

Because maximum performance from the original five basic factors—hence ability to produce at a profit—has become dependent on automatic devices.

One grain processor, for example, has set instrumentation as the prime objective in its development program and is currently uprooting complete plants to substitute new processes oriented around automatic control stations.

A candy bar maker is projecting the manufacture of his product on an absolute non-stop basis through almost visionary robotization.

A bakery mix company is moving, handling, blending tons of ingredients into delicate formulas daily through near-total robot supervision.

And automatic sequence control of aseptic canning is in pilot-plant operation.

The list could be added to in dozens, but to better understand the significance of these advanced plants let us consider some of the reasons behind this sudden food field emergence of this "sixth force," automatic control.

Perhaps the earliest organized use of automatic control appeared a quarter century ago in the regulation of newly mechanized bake ovens. The rudimentary "on-off" control used soon proved a necessity with new shortened baking time and large central production.

Successful use of simple on-off temperature control systems soon spread to other food operations. Cooking kettles and retorts were equipped. An automatic "leash" was placed on critical thermal processing to improve quality. The "art" of food manufacture was starting its metamorphosis toward a mature food engineering.

Automatic temperature control was followed by equivalent systems for regulating pressure and liquid level in process vessels. Hence, several robot devices often were employed in one process, or even on a single piece of equipment. This was the start of sophisticated, integrated instrument systems—with the early experimental instrumentation of sugar vacuum pans an example of this type of control complex.

As new precision came to process equipment through automatic control, an added virtue became evident—production could be sped through more acute processes and sequenced operation.

Faster, more efficient vat or kettle cooking was an example. Dependable end-point control when concentrating syrups in such vessels permitted use of higher steam jacket temperatures and more efficient heat transfer. This drastically cut processing time. Production was increased 23% by one preserver in 1935.

Going to the higher steam pressures in processing necessitated throttling type steam flow control. And familiarity with this equipment led to similar metering of water and syrups.

Advent of continuous flow control led to big changes in food processing. In sugar and milling processes, proportioning type valves were employed to regulate steam to continuous barrel heaters. This caused almost complete disappearance of vat or batch units for heating syrups. The precision the air-operated controllers achieved on these previously "wild" continuous heaters suggested many analogous applications.

Processes Uprooted

Dairy processors were pioneers in exploiting the possibilities of new throttling devices introduced by flow control. Automatically regulated continuous heaters replaced vats, and milk entered the start of its "pipeline" processing stage, which has been carried to a striking extreme in today's modern dairy.

Success of the automatically controlled dairy heater as the heart of "continuizing" in that industry appeared to set off a series of important changes elsewhere.

In the '30's streamlined band ovens with throttling zone control appeared, to replace batch and rotary types. Instrumentized tubular and plate sterilizers were set up for

many liquid acid food products. Robotized continuous cookers challenged the autoclave.

Nor was this instrument-spurred equipment revolution merely confined to pasteurizing and cooking procedures. Cabinet-type dryers evolved to productive, precisely controlled tunnel arrangements. And batch vacuum evaporators grew into instrument supervised multiple-effect systems.

Continuous Problems Met

Instruments proved a prime catalyst in the trend toward profit-salvaging continuous methods.

Fact was that former batch processes allowed leisurely manual control of such elusive product qualities as pH, density, color, and moisture content. Spot checks in the lab and slowing of operations for adjustments kept things in order. But processors were faced with huge quantities of crippled-product piling up when slight variations took place in the new continuous operation.

It was a twofold, urgently acute problem. Product in-process had to be kept on the beam or losses were prohibitive. And to do this by human supervision would mean an equally ruinous amount of labor cost along the line.

Then, in turn, the new processes required closer control all along the line—temperatures, pressures, flow, and levels. And this reflected in more uniform product.

But despite control of processing medium, product qualities still were unmanageable in many continuous operations. So new instruments had to be delivered.

Just about the first product quality automatically controlled in-stream was pH. In the mid-'30's this type of control—holding lime defecation to within 0.5 pH—brought higher yields to the sugar refining industry.

In-Stream Quality Control

War-born continuous concentration processes sparked the development of a number of product density control systems. One Florida plant found, for example, that automating its blending permitted it to run orange concentrate —formerly manually held within 2 deg. Brix—to within 0.2 deg. of optimum. It was estimated that this saved the company almost $1,000 a day in "giveaway" product. And the instrument installation cost less than $5,000.

Measuring and regulating electrical conductivity of process solutions proved another step toward in-stream quality control. Lye peeling solutions were rigidly regulated to permit fast, continuous peeling. By divorcing the worker from handling dangerous alkaline solutions, instruments paid for themselves in safety alone.

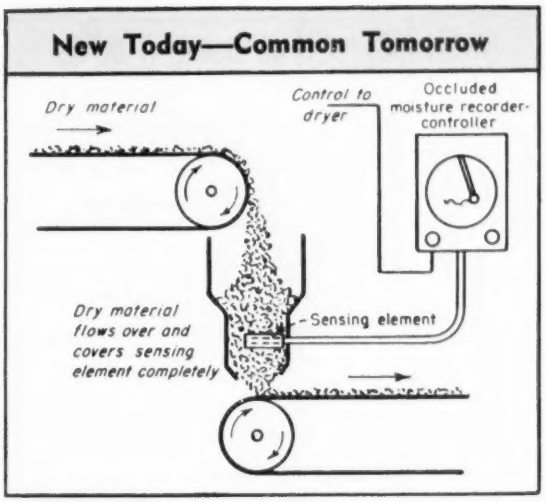
Color showed signs of succumbing to in-stream regulation in the postwar period. Photoelectric comparators adjusted oven speed in toasting of corn flakes.

In the past few years we find even more nebulous—but still highly important—product qualities being held by closed-loop control systems right in the process line. Among these are the viscosity of tomato products, the consistency and fluidity of chocolate coatings, oxygen content of both product and container headspace, moisture content of powders and granulated goods.

But before launching into a full-fledged discussion of current experimentation now going on in laboratories and its possible projection in the food plant of the future, it would be illuminating to review some of the snowballing instrument technology.

Versatile Controllers

From the simple thermostat of '28, which turned gas on and off in the oven, instruments have evolved to almost-human apparatus capable of sizing up all factors in a process and exerting deliberate control to hold its many facets in balance.



MOISTURE—With electric hygrometer in dry product stream, grain processor keeps moisture variation within 1%.

The first phase of instrument progress had to do with the way of control. From the simple on-off snap-switch contact, pneumatic throttling systems were developed that could move a control valve, for example, through more than 100 positions.

Later, this throttling action was augmented with refinements such as automatic reset and rate action, which served to stabilize its action under the most violent process conditions of surge and load change.

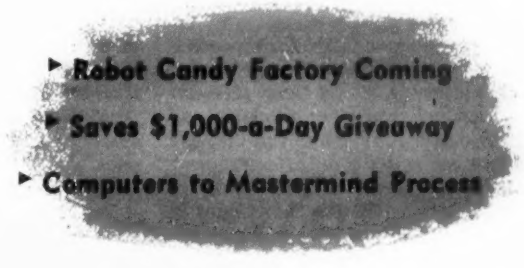
A parallel development of electric control forms offered action similar to pneumatic systems. Here, however, extremely versatile and remote operations could be accomplished through the use of simple electric wire and electric relay systems.

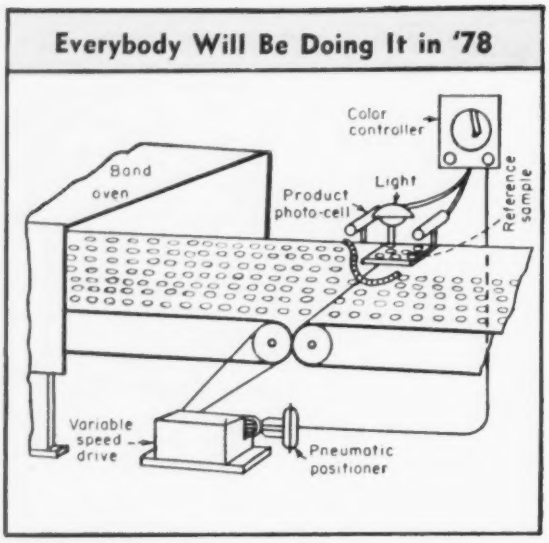
Eventually, compact pneumatic forms and versatile electric control devices combined to form today's widely rangeable electric-pneumatic-hydraulic systems. These can move a dam gate or add 0.0001 cc. of reagent to a process.

Electro-Sensing

Rapid development of electronic instrumentation opened a whole new vista in process control. It was a simple matter to pair the electronic controller with the glass electrode, conductivity cell, tachometer generator, or torque-tube viscosimeter.

New temperature sensing elements, such as the thermistor, can be the size of a pinhead yet capable of responding to temperature changes smaller than 0.01 deg. F. The versatile strain gage has been used for weighing, measuring





COLOR—On-belt color scanning set-up, developed by cereal processor, holds flake color at optimum by varying speed.

level, pressure gaging, and is currently revealed as the prime elements in a new mass flow meter.

Even more fruitful possibilities are opened with the adaptation of advanced laboratory analysis tools as primary sensing elements. Toward this end, in-stream mass-spectrometers, polaragraphs, and spectrophotometers have appeared in the plant. And some are being hooked-up to conventional bridge-type electronic recorder-controllers which do the workhorse job of automatic food process control.

Very recently a continuous control refractometer was announced which has considerable potential in handling sugar solutions and oils. The control sensitivity of this unit is claimed to be as small as 0.00001 specific gravity.

Graphics or Pushbuttons?

Today's big question is how to use this versatile instrumentation tool.

One school of thought holds that automation serves best by being subordinate to human supervision. Another believes implicity in completely robot-run operations—the so-called "pushbutton" process.

Some radical changes in instrument design have already been spurred by the "supervised-process" concept. We refer to the trend to miniaturization.

The object of miniaturization has been to provide small units to mount directly on the flow-lines of a graphic process panelboard for easy human supervision.

Proponents of pushbutton processing visualize a completely mechanized operation inaugurated from some remotes desk by a start-up switch. Substituted for human

(*Turn to page 236*)

Looking to the Future in Automatic Control

From the resume of fast-paced developments and trends of the past quarter century, two factors stand out as prime influences on automation of food plants in the next 25 years:

1—Necessary new instruments will be developed and applied to put quality control on an in-stream and automatic basis.

2—Integration and centralization of robot-directing forces will be necessary for simpler supervision of more and more complex processes.

Development of the necessary in-stream sensing devices is needed, of course, before true central robotization can occur. But there are definite signs that elusive food factors such as odor and taste will succumb to instrumentation in the future.

Consider food qualities that have begun to be gaged in-stream in recent years—color, consistency, fluidity, crystal state. These "virtually impossible" factors succumbed to control.

Some quiet and significant work is going on in laboratories of advanced food plants to set up these necessary quantitative scales for products and processes. Also some very fruitful efforts are under way to "continuize" many routine and tedious batch lab determinations such as fat content of milk and meat, alcohol in beverages, and starch content of flour.

Robotizing, based on new in-stream food quality measurements, will be the directing force in tomorrow's plant.

It is conceivable that fluid, semi-fluid, and free-flowing solid foods will be under almost complete instrument supervision. Tougher-to-handle, non-uniform products, such as meat, fruits, and vegetables, will still probably be subject to a certain amount of human judgment in their mechanized handling.

In-stream sensing elements check ingredients or materials as they move toward the process. These pick up necessary data, such as moisture, fat, protein, sugar, and starch content and send these on to the controller. Instantaneous instrument computations will thus constantly readjust the product formula—by varying feed rates or side additives—to abide by any inconstancies in ingredients.

Complete speed of operations, from feed-in to packaging, will be concisely meshed by the master controller. This, as mentioned, is about the only variable requiring human control so that production can be matched with availability of supplies and current product sales.

The master control station will be a combination of graphic panel, analog, and digital computer. A process-flow scheme with super-imposed instrument data or lights has been found necessary so that maintenance problems can be quickly spotted. The analog unit will provide the working "sinews" of the control system and the digital computer will work out formulation problems.

Guide to Your Action

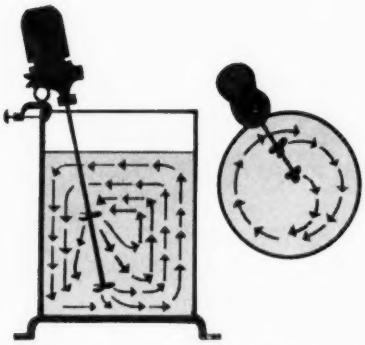
From now to '78 and beyond, forward-looking plant managers must use automation as a "sixth force". And here are the four steps that are essential in planning for automation:

First and foremost, a definite instrument department or group must be set-up and assigned solely to food process instrumentation.

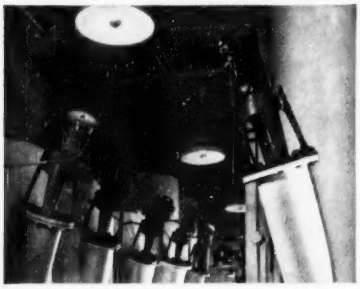
Second step is an organized review of all current processes by this group with an eye toward applying robot devices or redesigning to take full advantage of automatic control. Interesting and completely new processes may result from this unique appraisal.

Third, if not available, specific new instruments and devices may have to be developed to handle your particular product or match your process. The instrument group must be given free reign and money to do this work.

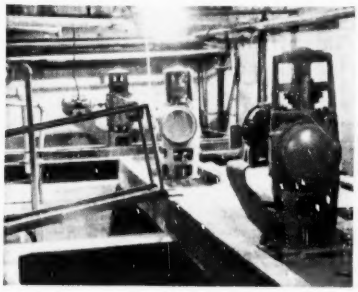
And finally, the findings of this engineering group must be put to work in a program of modernization.



DOUBLE MIXING ACTION is illustrated above. LIGHTNIN Portable Mixers are easily set at the right angle to mix at high speed, without vortex. Mixer can be rotated from one tank to another; swung out of tank for easy cleaning.



LIGHTNIN top entering propeller mixers, for open or closed tanks. Sizes ¼ to 3 HP.

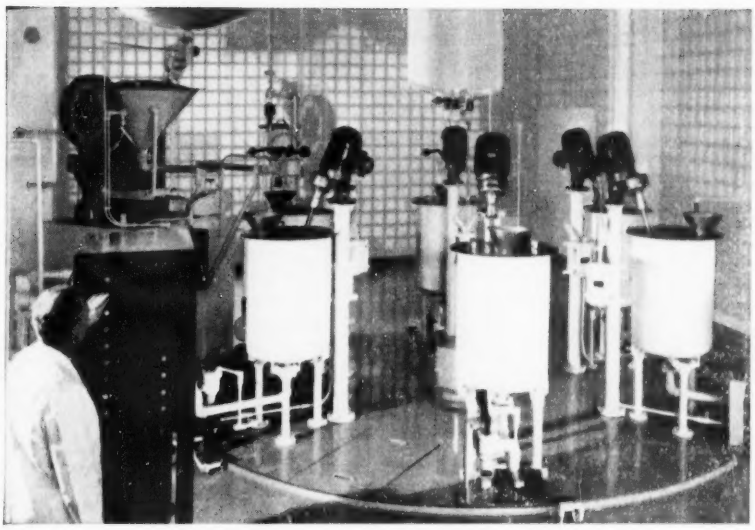


LIGHTNIN turbine and paddle mixers, for big mixing jobs, fit any open tank or closed pressure vessel. Full range of speeds, impellers, materials of construction. Sizes 1 to 500 HP.

Get these helpful LIGHTNIN Catalogs

This library of mixing information is yours for the asking. Catalogs contain helpful data on impeller selection; sizing; best type of vessel; valuable installation and operating hints; complete description of LIGHTNIN Mixers.

MIXCO fluid mixing specialists



LIGHTNIN Portable Mixers operating in strictly controlled sanitary conditions.

Try This Simple Way to Speed Up Fluid Mixing—

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This means intimate blending of liquids, quick dissolving of the finest powders, highly stable emulsions—uniform mixes that stay mixed.

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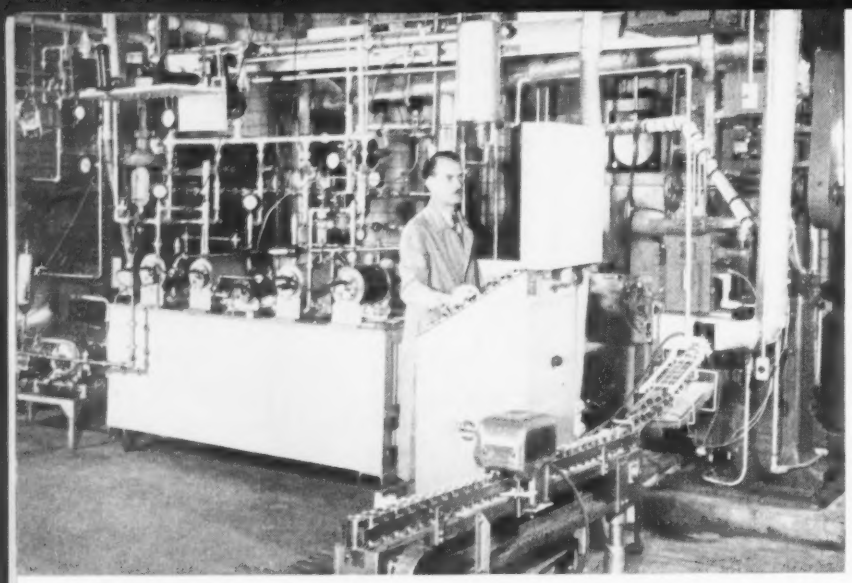
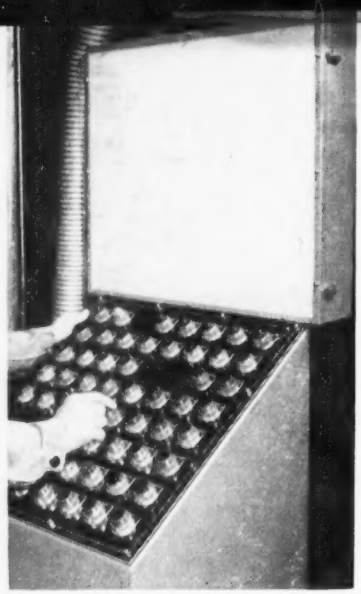


TOMORROW'S AUTOMATION—Pilot plant in which aseptic canning system and auxiliaries are operated by automatic sequence control.



CONTROL CONSOLE—Here are push-buttons, signal lights, graphic panel.

Automation for Tomorrow's Process

FOOD PROCESSES of the future will be under automatic sequence control. And we refer not only to the processing of fluids flowing continuously through pipes and heat exchangers—many of which already are instrumented—but to multi-step processes involving a wide and varied range of operations. Yes, even the manufacturing procedures requiring timing of mechanical process steps in coordinated sequence will be turned over to the automatic sequence control.

This is not idle speculation, but sure-bet forecasting. Why? Simply because the more advanced and efficient continuous processes require something better than human control. They call for elimination of the element of human failure—error, misjudgment, forgetfulness, or irresponsibility.

When several actions must be taken in sequence, at the right time and under a specified set of conditions, it is expecting too much for even the best of operators to perform day in and day out on a fool-proof basis. Yet perfection is required if product quality is to be maintained, if waste and spoilage are to be avoided, and if production capacity is to be maintained at maximum.

And all these things will be required in the food plant of tomorrow. There is no avoiding it.

Now as it happens, progress in this direction is much further along than most people in the industry know.

We have seen a very advanced automatic sequence control system operate a short-time, high-temperature aseptic canning process on a pilot-plant basis. And this sequence control is but an adaptation of a type of machine tool control long since proved highly practical, and essential, in commercial metal working operations. For that matter, it is in operation in refining processes used in the food and chemical fields.

The aseptic canning control involves automatic sequencing with features that make it adaptable, in modified form, to many other types of advanced food manufacturing operations. So we present it here in flowsheet detail, supplemented by a step-by-step account of what the sequence control does (page at right of flowsheet). Run through the sequence list and look at the flowsheet numbers to which it refers, and you easily get the picture of what can be done in robotizing the process of tomorrow.

First, however, look at the little diagrams below the flowsheet to get a quick concept of what is involved in the different phases of aseptic canning—sterilizing the system, canning, recirculation, and standby.

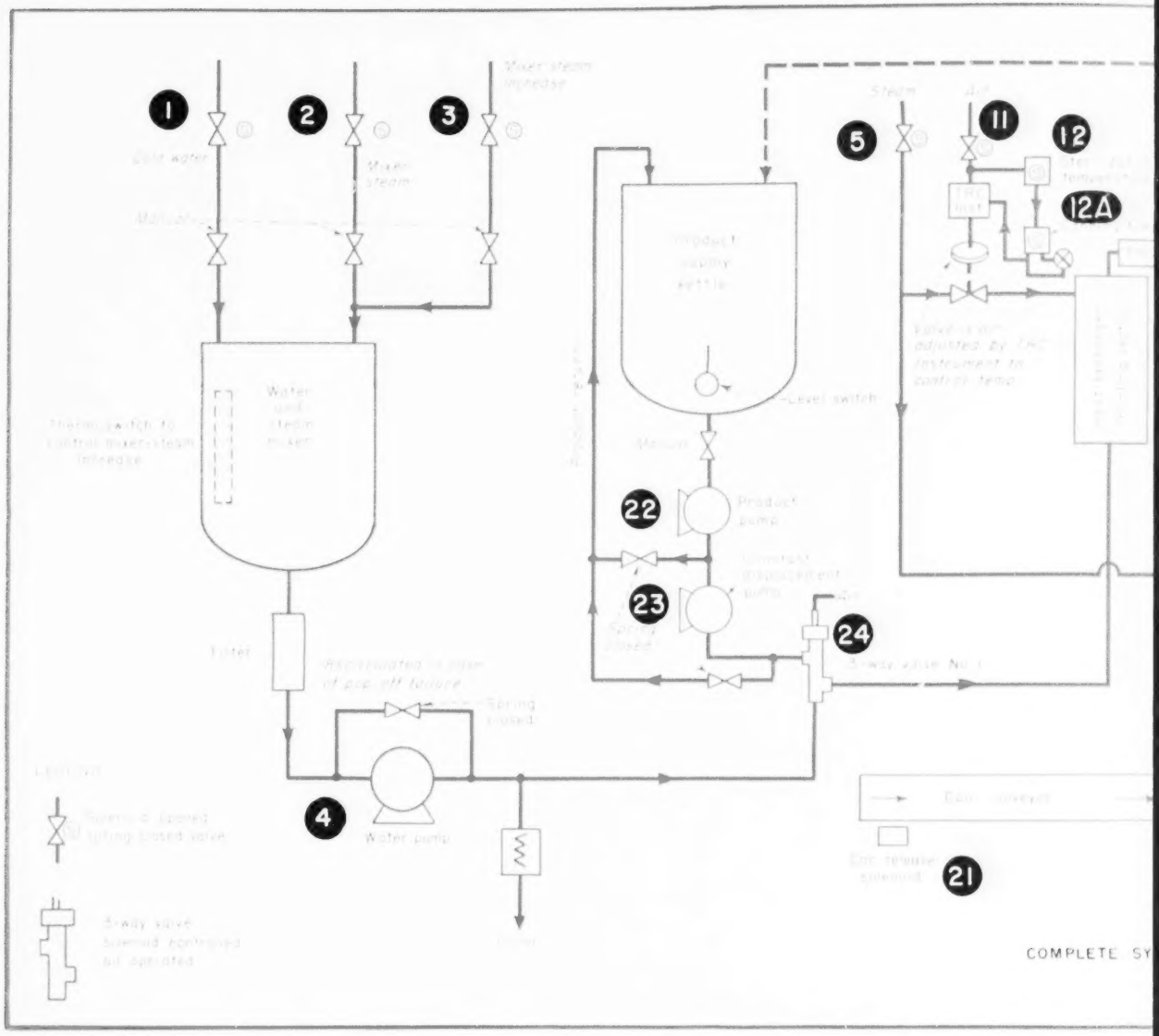
And note in tracing the sequence steps that positive end-point controls were used at all critical points, and that timers take care of many unusual conditions where critical endpoint control is not essential. You also will see that mechanical operations, as startup of can and lid feeds, are controlled, as well as process temperatures. Observe, too, these features: (1) The process-temperature control automatically adjusts itself from sterilizing to canning temperature. (2) One cylinder of the heat exchanger operates as a heater during one part of the cycle and is shifted to cooling at the right time. (3) The line to the drain and product-recirculate 3-way valve is sterilized before being closed for the canning cycle. (4) The hot heat exchanger cylinder continues to rotate until the system cools, to avoid heat seizure of the rotating element.

But most important of all, note that no matter what the operator does, the system cannot be put into the canning cycle unless all conditions are right, and safe, for canning. Chances for human error are eliminated.

While we strongly believe in the future of aseptic canning, this presentation deals with automatic sequence control of a food process, not with the process itself. We take aseptic canning as an example because an advanced sequence control has been engineered for it and is operating in a pilot plant.

We are talking reality, not conjecture, in terms of tomorrow.

Acknowledgment: Information and drawing on which this flowsheet is based were supplied by W. F. & John Barnes Co. Development and experimentation were carried out with the assistance of The Girdler Co., in its pilot plant.



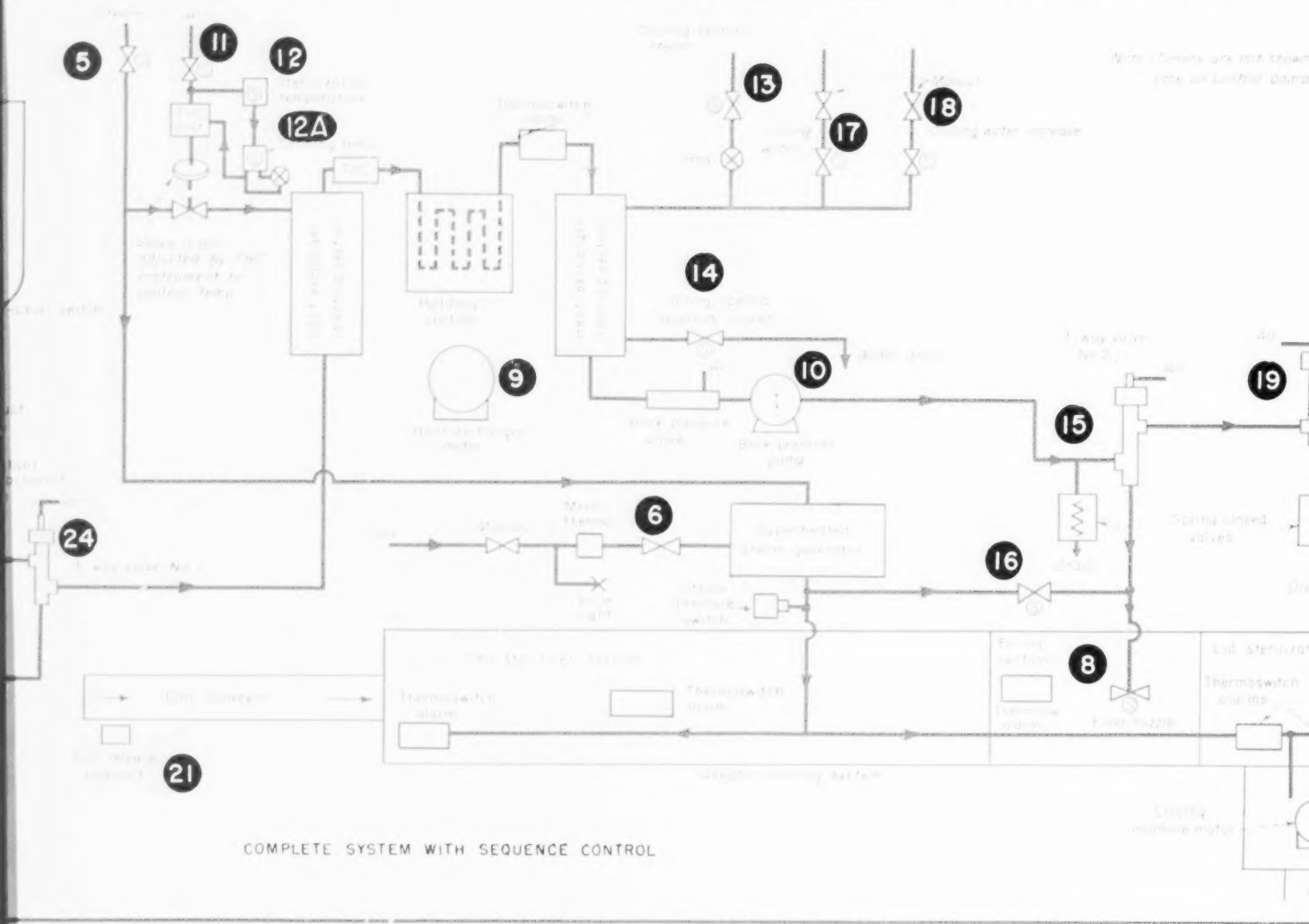
4 Cycles Explained

Four cycles, all interlocked, are incorporated into the system.

First the system is sterilized, then it is shifted to canning. And when minor trouble develops, the system recirculates the product.

In event of major trouble, the process is put into standby, water being circulated through the process system to drain to keep the system sterile.

So for sterilizing the system, and also on standby, water from the steam-water mixer tank (diagram at left) is circulated by pump through a three-way valve and through the product sterilizing system and the filler nozzle. For a time, hot water also flows through the second 3-way valve to make sure that the section between the two valves is sterilized.



COMPLETE SYSTEM WITH SEQUENCE CONTROL

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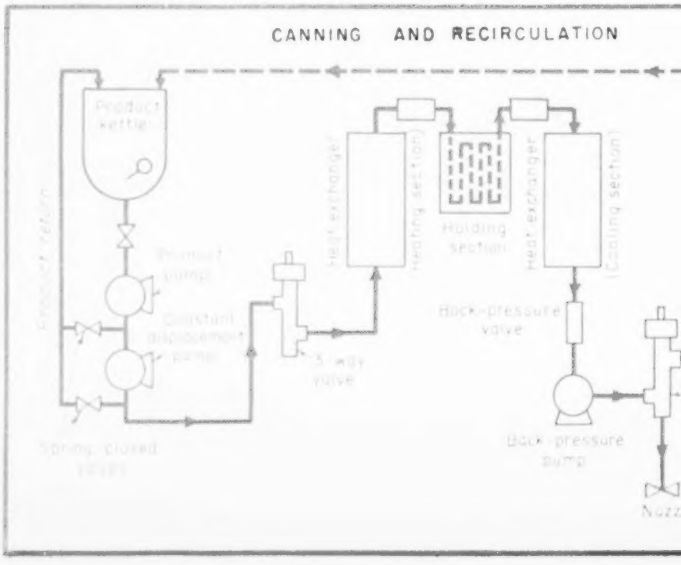
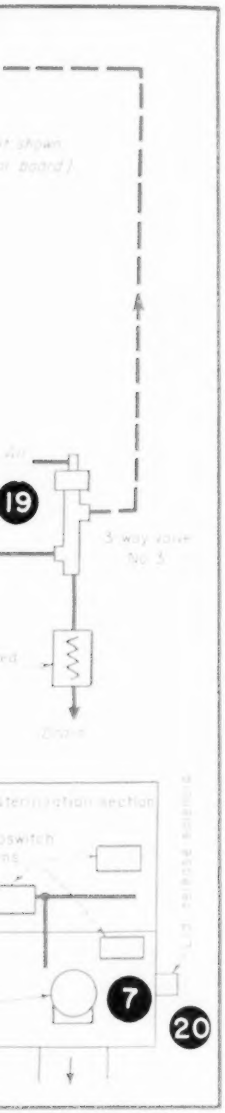
During sterilization, the second heat exchanger section operates as a heater for fast temperature rise. Then it shifts to cooling for the canning cycle.

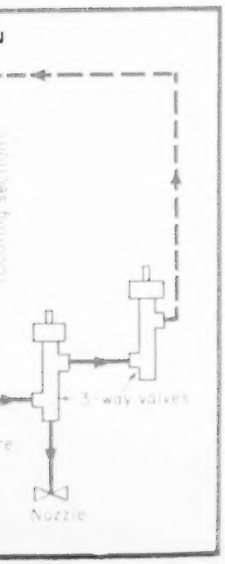
In canning (diagram at right), the product is pumped from the kettle through a heater and holding section for sterilization, then through a cooler. The cooled product is pumped through a 3-way valve to the filler nozzle.

For recirculation during brief delay, such as a momentary temperature drop, the product passes from the first 3-way valve through a second and back to the product kettle.

The product pump and constant-displacement pump are connected to a return line through spring-loaded valves to permit purging of air from the line and to release a too-high back pressure.







How Automatic Sequence Control Works

Sterilization

I. When operator presses "Cycle Start" pushbutton, these operations are automatically executed:

(A) Cold water valve opens (1). (See numbers on flow-sheet) . . . (B) Mixer steam valve opens (2) . . . (C) Mixer steam-increase valve opens (3). *NOTE: Mixer steam-increase valve is controlled by thermal switch to maintain water in mixer tank at predetermined temperature* . . . (D) Water pumps starts (4) . . . (E) Super-heater and heat exchanger steam valve opens (5). Then pressure switch at output line of super-heater opens super-heater gas valve (6) . . . (F) Closing machine and the take-away conveyor start (7) . . . (G) A timer starts . . . (H) Filler nozzle closes (8).

II. When the timer times out:

(A) Heat exchanger motor and the back-pressure pump go into operation (9 & 10) . . . (B) TRC instrument air-supply valve opens (11) . . . (C) Set-point on TRC instrument is energized to set for sterilization temperature (12) . . . (D) Heat exchanger cooling section steam valve opens (13) . . . (E) Water drain valve closes (14).

III. When temperature at the filler nozzle reaches 265 deg. F., a timer starts. And when this timer times out:

(A) Filler nozzle opens (8) . . . (B) Filler–Drain-Recirculate" 3-way valve (15) shifts from "Filler" to "Drain-Recirculate" . . . (C) Filler nozzle steam valve opens (16) . . . (D) Heat exchanger cooling section steam valve closes (13) . . . (E) Water drain valve opens (14) . . . (F) Heat exchanger cooling water valve opens, starting restricted flow (17) . . . (G) A timer starts. And when this timer times out, heat exchanger cooling-water-increase valve opens to give full flow (18) . . . (H) A timer starts.

IV. When this timer times out:

(A) Filler nozzle steam valve closes (16) . . . (B) "Filler–Drain-Recirculate" 3-way valve (19) shifts from "Drain-Recirculate" to "Filler."

V. When temperature at filler nozzle drops to 95 deg. F., and provided all alarm points are up, "Safe Canning" signal light comes on, indicating that system is completely sterilized. Machine is now ready for operation.

Canning

I. To process ("Safe Canning" light being on) operator presses "Start Canning" button, initiating these steps:

(A) Lids are released (20) . . . (B) Two timers start.

II. When first time times out: (A) Cans are released (21).

III. When second timer times out: (A) Product pump starts (22) . . . (B) A timer starts. IV. When this timer times out: (A) Constant displacement pumps start (23) . . . (B) A timer starts.

V. When this timer times out:

(A) "Water-Product" 3-way valve shifts from water to product (24) . . . (B) Timer starts.

VI. When this timer times out:

(A) Cold water valve closes (1) . . . (B) Mixer steam valve closes (2) . . . (C) Water pump stops (4) . . . (D) "Sterilization" temperature set-point is deenergized on TRC instrument (12) . . . (E) Set-point on TRC instrument is energized to set for "Canning" temperature (12A). Machine is now canning and will continue if no alarms occur.

Alarm Systems

Alarms signal operator if a motor becomes overloaded or if temperature is approaching critical point at any of alarm points of the machine. Thermal switches are adjusted to alarm at 3 or 4 deg. above the safe operating temperature.

In event of low-temperature alarm at any point (except the "Holding Section"), machine will automatically go into "Product Recirculate." If alarm is at "Holding Section", machine will go into "Standby" and light "Resterilize" lamp. Complete resterilization is then necessary.

Operator cannot go back into "Canning" until he presses the "Resterilize" pushbutton and waits for the "Safe Canning" light to come on.

When an alarm is initiated, horn will blow, green light indicating the point of trouble is extinguished, and its corresponding red light comes on. Operator presses "Stop Horn" button, checks panel lights to locate trouble.

When trouble is cleared, green light comes on again, but red light is on until "Start Canning" button is pressed.

In event of motor overload alarm, operator clears trouble and resets overload relay on motor starter that was at fault.

Product Recirculate

I. When the machine goes into "Product Recirculate":

(A) Alarm horn sounds . . . (B) Green alarm light for point where the temperature is down goes out . . . (C) Red alarm light for that point comes on . . . (D) "Filler–Drain-Recirculate" 3-way valve shifts from "Filler" to "Drain-Recirculate" (15) . . . (E) "Drain-Recirculate" 3-way valve shifts from "Drain" to "Recirculate" (19). System now is recirculating the product . . . (F) Timer starts.

II. Operator presses "Stop Alarm" pushbutton to silence horn and corrects trouble. Then, green alarm light comes on, indicating that temperature is back to normal. And operator presses "Start Canning" pushbutton.

(A) Red alarm light goes out . . . (B) Alarm system resets . . . (C) "Filler–Drain-Recirculate" 3-way valve shifts from "Drain-Recirculate" to "Filler" (15) . . . (D) "Drain-Recirculate" 3-way valve shifts from "Recirculate" to "Drain" (19). System now is back to normal canning operation.

III. If operator does not correct trouble and start canning before timer times out, machine goes into "Standby." This prevents recirculating product too long.

Standby

I. When machine goes into "Standby" it circulates water through system and down drain. Several things automatically initiate this.

(A) Safe recirculate timer times out . . . (B) Product kettle becomes empty (level switch) . . . (C) Temperature drops at "Holding Section." This requires complete resterilization. However, in a can or lid jam, or if for any other reason operator wishes to stop canning and still maintain sterility, "Standby" pushbutton must be pressed.

II. When machine goes into "Standby":

(A) Lid and can feeds stop (20 & 21) . . . (B) Cold water valve opens (1) . . . (C) Mixer steam increase valve opens (3) . . . (D) Water pump (4) starts, and two slow-release timers are de-energized . . . (E) When first of these timers times out, "Water-Product" 3-way valve shifts from "Product" to "Water" (24) . . . (F) When second timer cuts out, product pump stops (22), and constant displacement pump stops (23) . . . (C) "Canning" temperature set-point on TRC instrument is de-energized (12A) . . . (H) "Sterilization" temperature set-point on TRC instrument is energized (12). Machine now is circulating water through system.

III. To resume canning, operator presses "Start Canning" button. Machine repeats I to IV of "Canning."

Shutdown

I. Operator presses "Shutdown" button.

(A) Supply of lids and cans stops (20 & 21). (Approximately enough lids and cans remain in sterilizers to can product left in line.) . . . (B) Cold water valve opens (1) . . . (C) Water pump (4) starts and two slow-release timers are de-energized . . . (D) When first timer times out, "Water-Product" 3-way valve shifts from "Product" to "Water" (24) . . . (E) When second timer times out, product pump stops (22), and constant-displacement pump stops (23) . . . (F) A timer starts.

II. When this timer cuts out, all cans remaining in system have been filled and are out of machine.

(A) Closing machine stops (7) . . . (B) Super heater and heat exchanger steam valve closes (5) . . . (C) Super heater gas valve closes (6) . . . (D) "Canning" temperature set-point on TRC instrument is de-energized (12) . . . (E) TRC instrument air valve closes (11).

III. Machine now is circulating cold water through lines to drain to flush out and cool system. Temperature at "Holding Section" still is being indicated on TRC instrument, and back-set switch on this instrument now is controlling the power to entire machine. When temp. drops to 180 deg. F., TRC cuts off power.

(A) Cold water valve closes (1) . . . (B) Heat exchanger cooling water valves close (17 & 18) . . . (C) Heat exchanger motor and back pressure pump stop (9 & 10).

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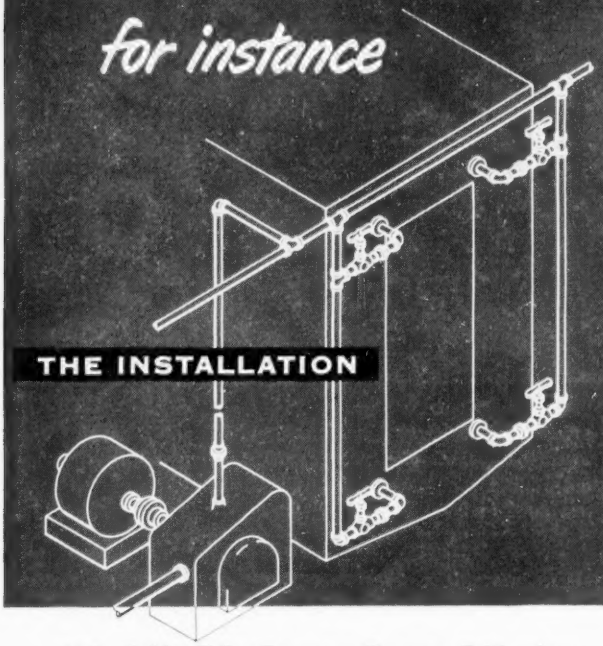
CHEVROLET first in demand in value in sales

There's a Big difference–even in Small Valves ...on Spray Driers, for instance



THE INSTALLATION

At the Golden Valley Creamery, Newman, Calif., where Crane Bar Stock valves replaced original lead regulator valves on spray process milk driers. They handle hot milk from high pressure pumps, at 2000 to 3000 psi, at a temperature of 180° F.

VALVE SERVICE RATINGS

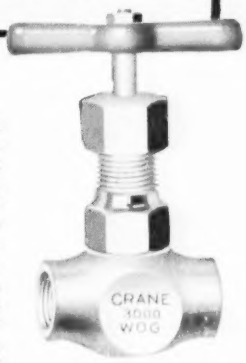
SUITABILITY:	Couldn't be better
FEATURES:	Solid bar stock construction
MAINTENANCE COST:	None
SERVICE LIFE:	Still top performance after 5 years
OPERATING RESULTS:	No shutdowns for valve repairs
AVAILABILITY:	Crane Catalog item – No. 222-SS

THE CASE HISTORY

The original equipment valves on these driers had a short life. They started failing quickly . . . couldn't be regulated . . . interrupting control of the process. Shutdowns for valve repairs were excessive; maintenance costs increased. The trouble was the stem threads were always stripping.

Not until all original valves were replaced with the sturdy, precision-made Crane 18-8 Mo Bar Stock valves, was the trouble completely stopped. That was more than 5 years ago. The Crane valves are still in the lines, holding down maintenance costs year after year, helping keep the plant at peak efficiency.

THE VALVE



You can see and feel the high quality of Crane Bar Stock valves. They're sturdy, compact and precision-crafted from solid steel, Exelloy, or 18-8 Mo, for cold working pressures up to 3000 psi. Sharply tapered disc gives closest flow regulation. Wide seating surfaces stay tight, resist wire drawing and cutting. You can't find a better valve for regulator leads, orifice meters, by-passes, and many similar services. Sizes up to 1-in. See your Crane Catalog or Crane Representative.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

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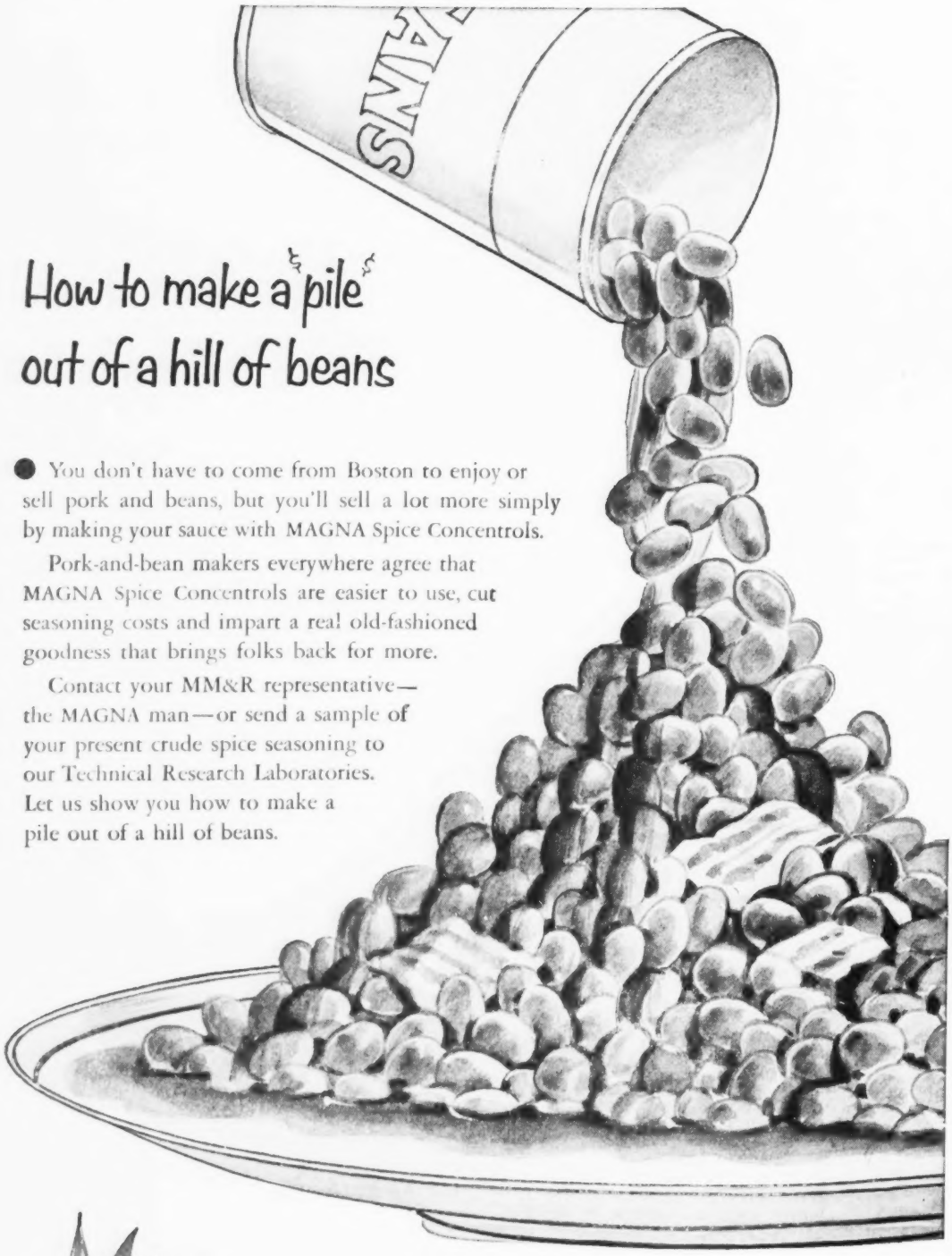

How to make a "pile" out of a hill of beans

● You don't have to come from Boston to enjoy or sell pork and beans, but you'll sell a lot more simply by making your sauce with MAGNA Spice Concentrols.

Pork-and-bean makers everywhere agree that MAGNA Spice Concentrols are easier to use, cut seasoning costs and impart a real old-fashioned goodness that brings folks back for more.

Contact your MM&R representative—the MAGNA man—or send a sample of your present crude spice seasoning to our Technical Research Laboratories. Let us show you how to make a pile out of a hill of beans.

M&R MAGNUS

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Since 1895 **ONE OF THE WORLD'S GREATEST SUPPLIERS OF ESSENTIAL OILS**

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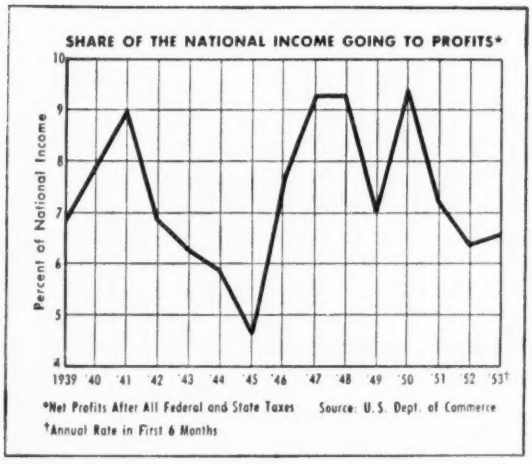
The first of two articles on profits

PROFITS...How High Are They?


SHARE OF THE NATIONAL INCOME GOING TO PROFITS*
Percent of National Income
10
9
8
7
6
5
4
1939 '40 '41 '42 '43 '44 '45 '46 '47 '48 '49 '50 '51 '52 '53†
*Net Profits After All Federal and State Taxes
†Annual Rate in First 6 Months
Source: U.S. Dept. of Commerce

How high are profits? What is being done with them? This is the first of two articles designed solely to throw some factual light on these key economic questions.

One of the important economic developments of 1953 has been a substantial increase in the dollar volume of corporation profits from the level of 1952. But to answer the question "How high are profits?" we must also measure them: 1) by comparison with the record of previous years, and 2) as a share of the total national income. The term "profits," as used here, refers to profits *after taxes*. These are the only profits that can be paid to stockholders or retained for use in the business.

In the first six months of 1953, corporate profits *after taxes* were at an annual rate of $20.4 billion. This was higher than in the first half of 1952, but lower than in the full years 1948 or 1950, or in the first half of 1951. If allowance is made for the declining value of the dollar, this year's net profits for all corporations represent less purchasing power than those made five or six years ago.

Here is the record of profits over the years:

	Net Profits After Taxes of All U.S. Corporations	
	Billions of Dollars	
	Actual	In 1953 Prices
1929	8.4	14.6
1939	5.0	9.8
1947	18.5	22.1
1948	20.7	22.7
1949	16.3	18.3
1950	22.7	24.6
1951	20.1	19.7
1952	18.6	18.7
1953*	20.4	20.4

*Annual rate, first six months

The record shows that real profits have a little more than doubled since 1939. This increase, however, does not mean that corporations are doing exceptionally well. The entire national income has doubled since 1939. And our industrial plant is more than twice as large as it was in 1939. Therefore, profits have just about kept pace with industrial growth.

Return on Investment

How high are profits compared with sales, or compared with the stockholders' investment?

What is the rate of return to the people who have invested their savings in corporate business?

The table below shows that for the past three years the rate of return on both sales and investment has been substantially below the return achieved in earlier postwar years. The rate of return on stockholders' investment is higher now than it was in 1939. But this is primarily because today's profits are reported in terms of today's prices, whereas much of the investment in plant facilities is still carried on the books at prewar prices, which are substantially below the cost of replacement. The current rate of return, measured as a percentage of total corporate sales, is below prewar levels.

	Corporate Profits After Taxes	
	Per Cent of Total Sales	Per Cent of Stockholders' Equity *
1929	6.1	NA
1939	4.1	4.0
1947	5.3	
1948	5.3	14.8 average
1949	4.4	
1950	5.3	
1951	4.1	11.8
1952	3.6	10.3
1953#	3.7	10.8

* Manufacturing corporations only
NA Not available
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In considering these figures, it should be remembered that they are averages for all corporations. Some companies make more than the average, and many make no profit at all. In every year since 1915 at least 25% of all corporations have operated at a loss. In 1939, 58% of all corporations were losing money. This year the figure will probably be at least 30%. The improvement since 1939 shows a much healthier economy. But it does not indicate that profits are easy to make.

How Big a Share of the Pie?

The most important single fact about profits is that they now represent a *smaller* share of national income than they have in past years of normal prosperity. For the past three years, profits have taken a smaller share of the pie than in 1939, and considerably smaller than in the early postwar years. Here, as the chart at the beginning shows, is the record:

	Corporate Profits After Taxes as a Percentage of National Income
1929	9.6
1939	6.9
1947	9.3
1948	9.3
1949	7.5
1950	9.4
1951	7.2
1952	6.4
1953*	6.6

*Annual rate, first six months

The main reason for the declining corporate share of national income is, of course, the increasing share taken by the federal government in the form of taxes. The wage earners' share is also higher than in 1939. But the really startling increase is in federal taxes. Taxes on profits now equal almost 8% of the national income, compared to only 2% in 1939.

Why This Is Important

It is important that these facts about profits and taxes be widely understood. At its next session, Congress must consider what to do about the emergency taxes on profits enacted after the outbreak of the Korean War. The so-called excess profits tax is scheduled to die on January 1, 1954. In the absence of new legislation, the rate of the corporate income tax will drop from 52% to 47% on April 1. Many factors, including the revenue needs of the government, must enter into the decision whether or not to reduce taxes. But one fact stands out clearly: By comparison either with past years or with the total national income, corporate profits today are relatively low.

* * *

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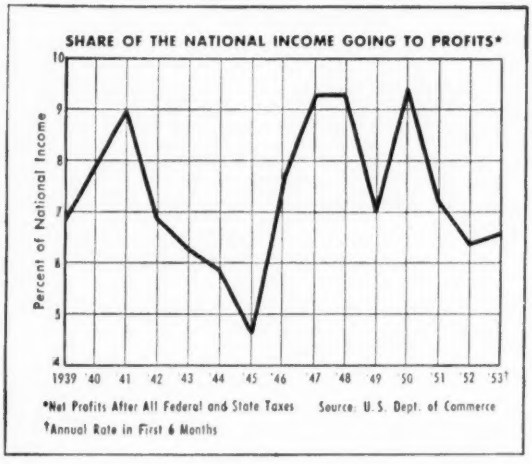
The first of two articles on profits

PROFITS...How High Are They?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PACKAGING MACHINES

PACKAGING has come further since 1928 than in all previous history. Credited are the dramatic mechanization strides. They have kept packaging performance climbing upward—and are seen propelling it to an even faster pace in the next 25 years.

Further, the striving for continuous, high-volume processing has tremendously stimulated packaging speeds and efficiency.

Based on a survey of 17 different types of food packaging lines, hourly worker output jumped from 525 units in 1928 to a present 2,550—almost a 400% increase! Meanwhile, line crews have been stripped to a third.

During this 25-yr. period, not only has cost per unit of product handled been radically snipped, but more highly engineered packaging has contributed other notable extras by (1) curbing waste of packaging materials, (2) turning out more uniform quality packages, (3) reducing floor space needs, (4) minimizing maintenance requirements and change-over time, (5) assuring more accurate fills, and (6) enabling the packaging of a variety of products in different size units by the same equipment.

Since 1928, more packaged foods have been sold in supermarkets on the basis of attractive appearance—an emphasis on the need for better wrapping, labeling, and cartoning.

Marked advances have been achieved by equipment manufacturers since 1928. For example, the number of heads on fillers, cappers, and can closers have steadily increased to accommodate higher speeds. And, in some cases, the appearance of thermoplastic labelers has overcome a long-existing bottleneck. Also, glue labelers were set up in tandem to handle 330 bottles a minute.

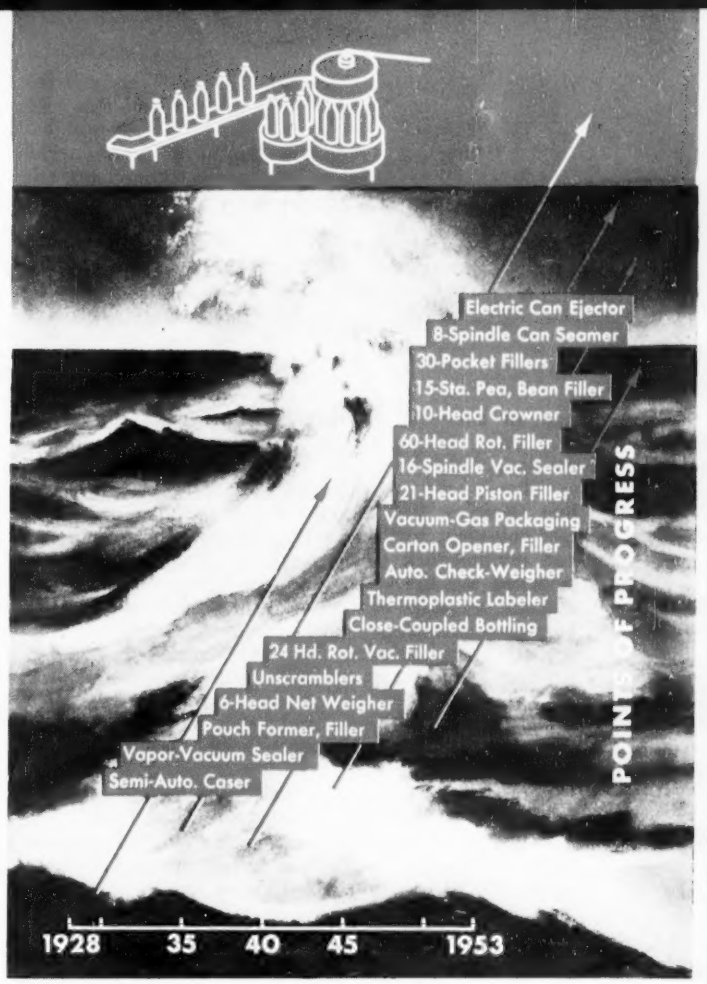
Some machines were built for multiple functions—filling and labeling, weighing and filling products into bags that are formed and sealed by the same unit, forming lined packages from carton blanks and roll-fed film, and grouping packages that are automatically inserted into cartons or cases.

Special devices have curbed production delays. Among them: Screw-type feeders, "no-bottle no-label" devices, overload safety clutches, microswitches, and countless others.

Materials of construction improved machine preformance. Playing a stellar role was Teflon applied to certain machine parts. By switching from metal to Formica, starwheels withstand shocks better, reducing glass breakage. Lightweight metals and alloys have added speed and strength to machines with reciprocating parts.

Simplicity, Accessibility Set Trend

Machines with fewer, simply designed, and accessible parts have set the trend. Some were designed to take up less space. Take the case of the new bottling lines with double-deck pasteurizers that handle twice the volume in the same amount of space as single-decker units.



Points of progress are equipment developments.

To check production tie-ups attributable to "burnt-up" machine parts, more efficient lubricating techniques were evolved. Too, improved lubricants were made available to withstand heavy punishment.

Packaging materials and containers were also improved for handling by higher speed machines. These included the jars, bottles, cans, labels, adhesives, wrappers, cartons, and shipping cases.

In general, the trend toward automatic packaging in all branches of the food industry has been strong. Major changes on typical packaging lines, for the past 25 years, have looked like this:

Beer Bottling and Canning—Since repeal, the precentage of packaged beer has climbed from about 25 to 75. No wonder lines had to operate faster.

A swift bottling line in 1934 did 200 a min. with a 16-man crew. Today, a 7-man line bottles 330—an approximate 65% rise in output and a 56% reduction in the crew.

Greatest consumer of manpower on the early bottling line was the pasteurizer. Within a year or so after repeal, introduction of continuous, spray-type pasteurizers, with automatic loading and unloading devices, completely solved the manpower problem. And the newer double-deck pasteurizers had a significant effect in boosting production and reducing floor space requirements.

Major advance about 1934 was combining the filler and crowner so that they were synchronized for smoother operation, higher speed, and better control of bottle feed. And they take up less space. Shortly before the

▸ **Worker Output Rises 400%**

▸ **Beer Soars to 31,800 Cans/Hr.**

▸ **Line Workers Slashed to Third**

war, an automatic lubricating system was featured to give longer life to machine parts and eliminate much maintenance.

Following the war came newer machines that increased line efficiency and output. These included automatic case unloaders, bottle-inspecting devices, tandem labelers, and multiple-pack casing machines. Perhaps the more advanced was the 400-bottle-per-min. case unloader that relieved operators of the most unpleasant job in the bottling department.

Early lines included 34-valve fillers, 12-bottle-wide soakers, 2-head crowners, and 3-unit tandem labelers. Now there are 60-head rotary fillers, 32-bottle wide soakers, 10-head crowners, and 6-unit tandem labelers.

Reported year-'round production efficiency on bottling lines is 95%.

During this 25-yr. period, quality of bottles were also improved for handling at faster speeds—and with less breakage. Bottles are now individually handled to avoid scuffing and impact damage. Conveyors, for example, have been replaced with a combination of feeding starwheels. The trend was to become more automatic features supplanting manual operations.

Big Climbs

Beer-canning lines readily kept up with production. Earliest 10-man lines canned 240 a min. Today, the rate is 530 on a single line employing 6 men, and it is 840 on a double line requiring only 7 operators. This means a 120% jump in hourly worker output on a single line and a 40% cut in the crew. Output zoomed 250% on the double line, while the number of workers dropped to 30%.

Many factors contributed to these efficiencies. Together with other improvements on machines, more filling valves were added to the fillers as well as more heads to the can closers. Unscramblers, case packers, and automatic can-level checkers were developed.

Bottling Soft Drinks—Notable efficiencies were engineered into beverage lines within the 25 years. Early speed on a 12-oz. bottle line, employing 7 men, was about 100 a min. Now, the same number of operators are bottling 330 a min.

To match this higher capacity, bottle soakers were made wider, more heads were added to the crowner, filler and crowner were synchronized, additional labelers were arranged in tandem, and case unloaders and case packers appeared.

Bottling lines were doing 200 per min. about 1934, 260 during the war, and 315 about 1950. And now, for the first time, none of the bottling crew does manual work. Each one serves in a supervisory and inspection capacity.

Ketchup Bottling—Basic objective on ketchup lines, since 1928, has been speed. As late as 1928, line speed was only about 100 per min. But in 2½ decades it has topped 350. Meanwhile, automation has been responsible for a 75% reduction in the crew—from bottle washer, through filler and capper, to cooler.

Two changes, above all others—the vapor-vacuum sealing and vacuum filling techniques—enabled ketchup bottlers to attain this 250% increase in production. Also significant was the advent of unscramblers, automatic loading of bottles to washer-rinser, and uninterrupted bottle travel.

Bottling Wines—Capacity of wine-bottling lines has climbed, since repeal, from about 30 to 120 per min., and the number of line workers has been drastically cut from about 15 to 6. Line-output boosters have been automatic bottle cleaners, 30-head rotary fillers, and 4-head cappers. Significant has been the switch from manual corking to automatic capping. Recently replacing hand labor, too, are the automatic cellulose banding machines.

Jam and Jelly Lines—Marked advances have been attained on jelly lines since the late twenties. Important were the departures from open-kettle cooking to vacuum pans and, in a few cases, to the Reich continuous process. One operator, for example, can produce eight times as much with two 2,000-lb. vacuum pans as another with five 200-lb. kettles. And the continuous process can turn out 125,000 lb. hourly.

To keep up with this high-volume output, filling-line speeds shot up 200% in 2½ decades. Also, the line crew was slashed from 8 to 5.

Two pace setters were responsible for higher filling-line speeds—the 600-per-min. press-on vacuum capper and the 300-per-min. thermoplastic labeler. Other major changes involved the installation of automatic case unloaders, case sealer, semi-automatic case packer, and continuous cooler. Too, there has been a switch from straightline, 6-head, 60-per-min. fillers to rotary, 16-head, 220-per-min. ones.

Packing Dressing Products—Present trend toward continuous manufacture of mayonnaise and salad dressing calls for higher filling-line speeds. Filling speeds have only doubled since 1928. Back in '28, line speeds were 60 pint jars a min. Employed on a line were about 8 workers operating a 4-head piston-type filler and capper. Jars were hand-packed into cases, which were then manually sealed.

Now, 6 operators produce 120 jars a min. The line comprises unscrambler, 10-spout straightline filler, 4-head capper, and automatic case sealer.

Packaging Small Pies—Average line of 25 years ago had about 46 operators, each packaging 600 pies hourly. Now, three girls pack 4,800 an hour. Thus, hourly output per worker has risen 167%.

Advent of a wrapping machine in 1932 boosted output to 900 pies hourly per girl, and reduced the crew to about 28. About 1940, another machine was introduced which upped worker output to about 1,200 an hour and cut down the crew to 16 girls. Aside from labor savings (only three girls required) and increased production, notable savings in packaging materials are obtained with the present wrapping machine.

Macaroni Packaging—Most outstanding, since the late '20's, has been the packaging of short-cut goods. Then 10 operators produced 2,100 packages on a line, which comprised a 2-pocket filler, "biscuit-type" carton former, carton closer, and wrapping machine.

On a line now, 1½ operators turn out 5,760 packages hourly—an 85% reduction in workers and a 174% jump in output. This line consists of a 4-mandrel carton former and bottom sealer, 6-head net weigher, top-carton sealer, case packer, and case sealer.

This speedy packaging was thrust upon manufacturers through the development of continuous macaroni presses and dryers. Before 1939, it took 6 men 1 hr. to make 600 lb. of macaroni by the batch method. One man now handles six lines and produces 6,000 lb. an hour!

But efficient packaging took some time in coming.

After the war, a 2-man crew put up 2,100 upright cartons an hour!

Hourly 14-worker output on a long-goods line in 1928 was about 3,500 cartons. This line comprised a carton former, with 7 girls to weigh and pack and 2 to hand-pack and seal cases. Product and packaging materials were supplied by 2 men.

Today, a linerless cartoning machine and conveyor for feeding goods to the line requires 12 girls (10 weighing and packing and 2 casing) to package 5,000 cartons hourly. This is an increase of 43% in output, but only a 15% cut in the number of workers.

Unlike short goods, packaging of the long variety has not kept pace with the higher volume production. Introduction of continuous and automatic presses, spreaders, and dryers enabled 1 operator to make 2,000 lb. of spaghetti an hour on two lines. Formerly made: 600 lb. an hour.

Until now, small-plant operators have been unable to compete packaging cost-wise with large ones. But the advent of a new, flexible packaging machine (for short and long goods) now lets the small fellow obtain higher output per worker than the larger, more costlier ones. For example, 4 girls using the new machine now package 14,400 1-lb. units of long goods daily, or 3,600 per worker. A typical 12-girl cartoning line produces 32,000 daily, or 2,800 per girl.

Bread Wrapping—Back in the early '30's, 2 men ran a machine that sliced and wrapped 2,400 loaves an hour. Today, 2 men slice and wrap 14,400 loaves an hour. One operating a tier selector group-feeds loaves to a battery of four slicing-wrapping machines run by the second man.

Prepared Cake Mixes—Here, hourly output per line soared from about 3,000 to 4,200 packages in a little over two decades, while the working crew has been sharply cut from about 12 to 5.

Improvements have come about through the development of a double-package maker, 2-scale weigher (with cone feed), improved tight wrapper, case packer, dry shortening, better packaging materials, and an air-conveying system for delivering more uniform mixes to the filling units.

Packaging Cookies—Except for a few items, packaging has not kept pace with the 10,500-cookie-per-min. production from a continuous band oven—more than triple the amount baked in a reel oven prior to 1932.

Earlier, 12 girls cartoned 30 a min. on a line consisting of a package maker, filler, top sealer, and tight wrapper. More efficient machines now require only 4 operators to put up 78 a min.

Automatic pouch-forming and filling machines are now handling the entire production of vanilla wafers from a band oven—and with only a single operator. One firm even made its cracker line completely automatic. Packaging, in this case, is no longer a separate operation, but geared 110% to oven production. Crackers are machine-stacked and wrapped into 4-lb. units, which are automatically packed four to a carton.

Wrapping Frozen Foods—About two decades ago, approximately 6 workers packaged 30 cartons a min. After the war, speeds zipped to 100. And now, a 180-per-min. wrapping machine is almost "ready to go" that will handle end-filled cartons from a 225-per-min. volumetric filler.

Candy Bars—Steady improvements on wrapping machines—particularly from a viewpoint of reducing reciprocating motions—have brought about a two-fold increase in candy-bar wrapping.

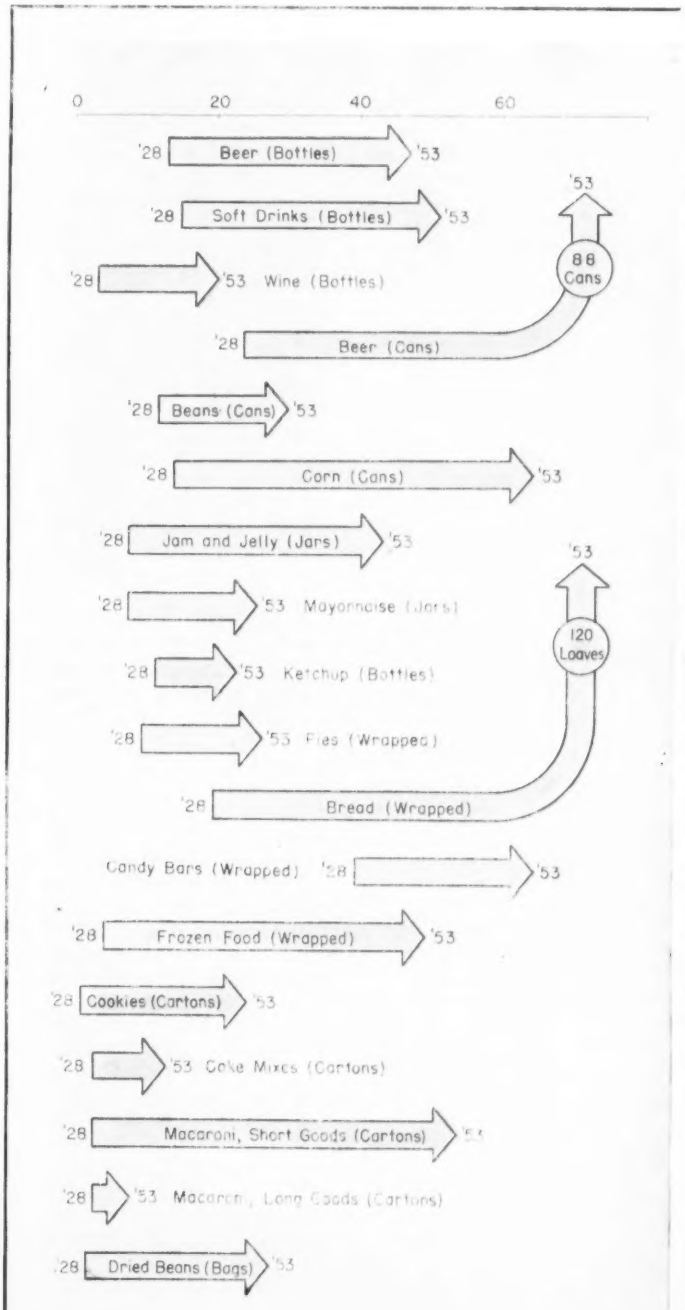
Bagging Dried Beans—While higher speeds in the bagging of such items as dried beans and peas have not been dramatic since 1928, recent development of faster, multi-function machines has. Back in '28, it took a 4-girl crew to bag 10 a min. New machines now form bags from roll-fed film, weigh and fill, seal top of bag, and check-weigh 38 a min.—and with 1 girl.

Canning Beans—Speeds on pork and bean canning line have risen, within 25 years, from 120 to 300 per min. with the same number of workers. Credited is the advent of unscramblers, more pockets on fillers, combined bean and sauce filler, and automatic case packers and sealers.

Canning Corn—Output on a corn-canning line has more than doubled within 25 years—from 120 to 250 per min. Working crew on a line has been reduced from 9 to 4.

By switching from batch to continuous cookers and coolers, large firms have been able to eliminate considerable manual handling. Greater line efficiencies were also

Big '28-'53 Climb in Worker Output per Minute



attained by increasing the filler pockets from 6 to 10 and using lithographed cans that eliminated labeling.

Canning Peas—Hourly speeds on pea-canning lines rose, since 1928, from 7,500 to 12,000, while the working crew was cut from 10 to 8. Responsible for this increased efficiency were higher speed closing machines, automatic case packers, and continuous cooker-coolers.

Canning Citrus Juice—Output was increased 627%—from 3,300 to 24,000 cans hourly—on citrus juice lines since 1928. Similarly, the number of line workers was reduced from 10 to 8.

Greater productivity was achieved through development of higher speed closing machines in 1934, 1940, and 1953. Heads on closing machines were increased from 1 to 4 to 6.

Filler valves were also increased—from 6 to 10, 12, 14, 16, 18, and 24. Fully automatic handling of empty and filled cans appeared in 1940. And lithographed cans were introduced for concentrates.

What's Coming and What to Do

Trend toward speedier automatic packaging will continue to be strong in all branches of the food industry. Chief emphasis will be on the lowest cost packaging per unit, also on more accurate fills and better quality packages.

Undoubtedly, as time goes on, more will be learned by equipment manufacturers about packaging problems. But before the user can expect the equipment maker to come up with improvements, he must make his problems known.

It appears likely that 25 years from now items like candy and crackers will be automatically packaged by count. Before this takes place, statistical control measures must be devised to control size, thickness, and density of product.

Packagers think that sterilization of certain packaged foods will be achieved before 1978 by ionizing radiation. Most significant trend now foreseen is extensive use of unit-type packaging of free-flowing solids and viscous products like jellies, mustard, dressings, and the like. Machines will form, from a roll, packet, which will be filled and sealed at rates exceeding 1,000 a min.

Problem of setting up the newer, better machines for short-run jobs will be simplified through improvements in electrical controls and mechanical features. Future trend is to substitute electrical controls for operator skill. These smoother running, electrically controlled machines may also do away with job training. As salaries and cost of materials rise, every dollar of these increases will come from reduced operating costs.

Aside from development of more efficient machines, work simplication methods will continue to reduce packaging line costs. Future developments will be achieved through automatic loading devices, adding more heads to fillers and crowners, and synchronizing two or more machines.

By going from a 2- to a 4- or 6-head Stokeswrap or Transwrap machine, three-dimensional packages may be made and filled at speeds up to 120 a min. The multi-head wrapping machine design, tried experimentally, points to what may come in higher speed wrapping.

Items like prepared cake mixes, now packed in cartons, may be put up in laminated foil bags, such as foil-to-polyethylene or bleached kraft coated with polyethylene. By going to these bags, processors will cut cost of packaging materials, reduce equipment requirements, and get better protective packages at speeds up to 120 a min.

Advances in supersonic mixing of cake mixes, for example, may be responsible for filling speeds considerably higher than present ones. More uniform distribution of ingredients by this technique may permit the use of rotary-type, multi-head volumetric fillers. Of course, this speed may mean hooking up in tandem, such units as the double-package maker or tight wrapper.

Improvements in weighing may be achieved through greater use of hydraulic systems. Processors may learn more about speeding movement of products to scale hoppers.

Here's an example of what may be done to speed up carton-filling lines: Number of mandrels on package makers may be increased. Maybe a duplex-type package maker will appear. More filling heads may be attached to fillers, which could also be set up in tandem. Or faster, continuous-type tight wrappers may be built. Moreover, package makers may be designed to form cartons from roll-fed paperboard rather than knocked-down cartons—and at a savings.

There will be more reliance on improved regulating systems to perform control functions, because of precision, reliability, speed of response, and simplicity of maintenance. Look for greater reliability to be built into future units for improved continuity of performance.

Calls for higher speeds will mean the building of equipment with the latest control instruments and other components essential for completely automatic packaging. It means further the replacement—and at a faster rate—of obsolete, low production machines with new, speedier ones. Other foreseeable trends are:

Higher speed machines for packaging short-cut macaroni—ones capable of accurately weighing up to 130 cartons per min. will come within 5 years. Beyond 5 years, some manufacturers believe that line output will be doubled by hooking up two 6-head weighing machines in tandem. Biggest problem to lick in packaging long goods will be the elimination of hand-weighing and packing.

Beer-canning line speeds will go up to 600 a min. within 3 years. One equipment manufacturer thinks that a rotary filler may be designed with the present 60 filler lifts supplying bottles to 120 filling valves. Speeds might then go to 1,000.

Bottling of beer and soft drinks is expected to increase about 25% within 2 years. After that time, bottle soakers will be made wider. And if more filling valves won't be added to machines, then fillers will be arranged in tandem. Lines will be shortened, and more double-deck units may appear.

Another equipment maker believes bottling speeds will be stepped up to 450-500 a min., with 70-75 valve fillers, 12-head crowners, and additional labelers.

Doubling present speeds—up to 220 a min.—is foreseen on wine-bottling lines in the very near future. Higher capacity fillers, cappers, and labelers will make this possible.

Higher speeds—as 550 cans of baked beans—are expected by increasing the number of pockets on the filler-syruper and using an 8-spindle can closer. Some automatic device may be designed for dropping pork into cans. And electronic label inspectors will continue to be used on many can lines.

From an accuracy and labor-saving angle, use of a new check-weighing system is foreseen. Unit will check-weigh 90 packages a minute, analyze weight variations, and operate a servo-mechanism to adjust filler.

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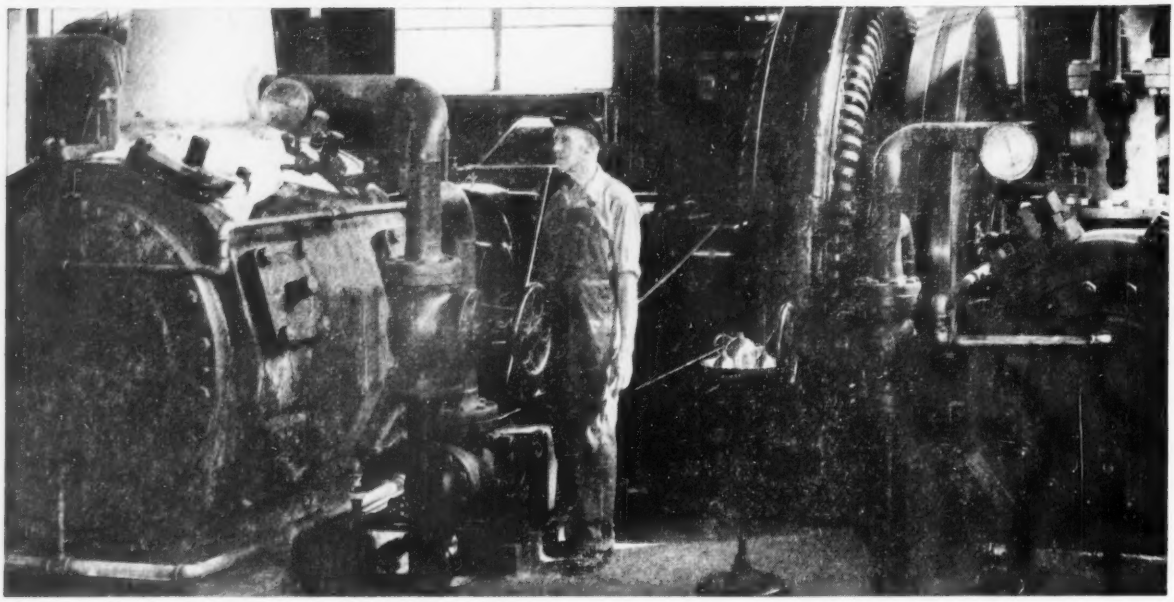
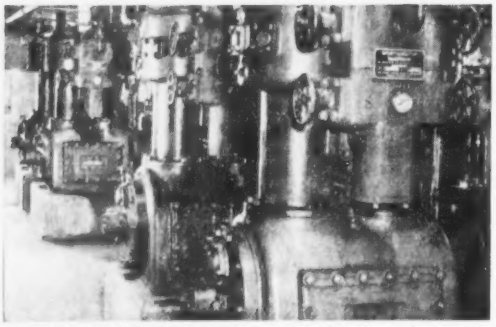
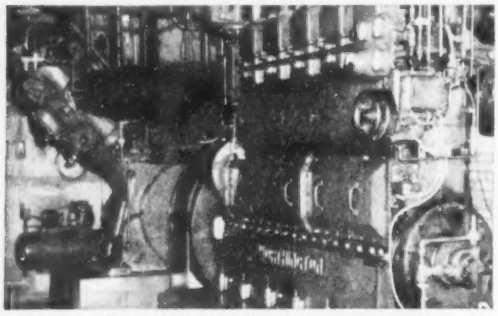


THE FIRST WORTHINGTON AMMONIA COMPRESSOR EVER BUILT, installed at Quincy Market 35 years ago.



DEPENDABLE REFRIGERATION is supplied by these four modern Worthington vertical ammonia compressors at Quincy Market's Watertown, Mass., plant.



ANOTHER WORTHINGTON AMMONIA COMPRESSOR at the Watertown plant. This one is a two-stage, "Y" type, driven by a Worthington Diesel.

Worthington ammonia compressor still in daily use after 35 years

Back in 1918, the Quincy Market Cold Storage & Warehouse Company in Boston bought its first Worthington ammonia refrigeration compressor.

This machine, a horizontal two-stage unit running at 164 rpm, and having a capacity of about 400 tons of sub-zero refrigeration, was the starting point for drastic changes in the engineering of ammonia compressors. Eventually, the principles of design established in this initial unit were adopted by all refrigeration manufacturers.

The compressor Worthington built for Quincy Market in 1918 is still in service—after 35 years of heavy-duty operation. And today, in Quincy Market's T Wharf and Sargents Wharf power plants in Boston, their new frozen food warehouses in Watertown, Mass., Portland, Maine, and their warehouse in Troy, N. Y., many other installations of Worthington equipment are supplying dependable, efficient refrigeration. The Quincy Market has been famous for over 60 years for the quality storage of millions of pounds of frozen foods.

For over half a century, Worthington refrigeration equipment has been serving the "first names" in the food industry. So when you think of refrigeration—think of Worthington. Get in touch with your nearest Worthington district office, or write Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.3.5, Harrison, N. J.

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PACKAGING MATERIALS

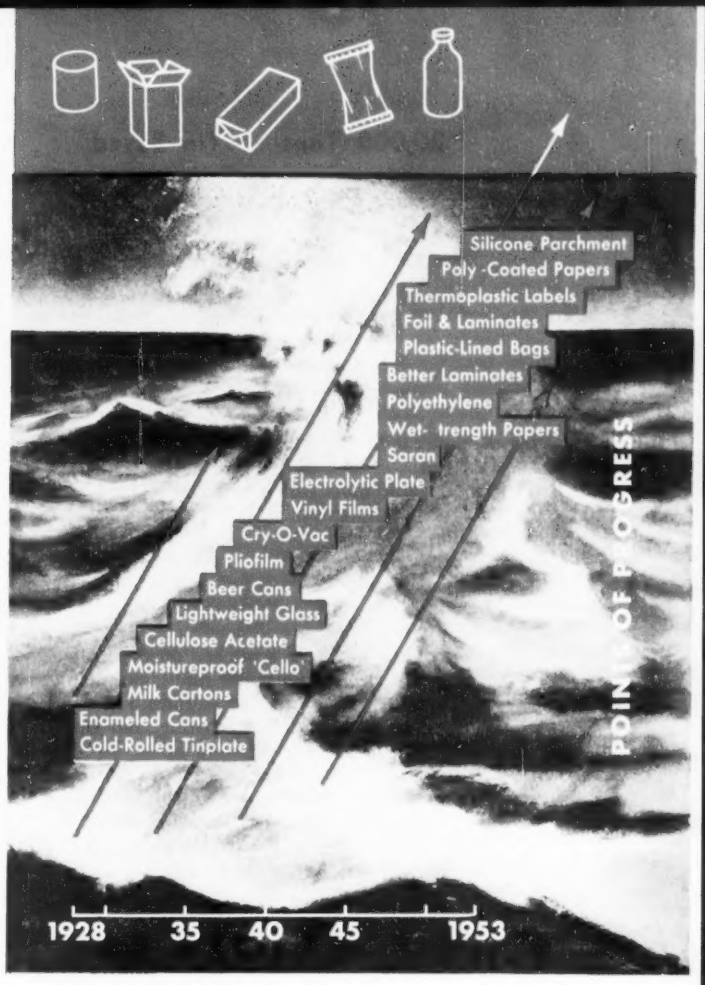
THE ERA of modern packaging was ushered in with the supermarkets in the early '30's. And since then, newer materials, combinations of them, and extension of their uses have enabled the food industry to handle them faster on higher speed packaging lines, to protect products better, and to sell packaged foods faster and in decidedly greater volume.

Economical prepacking of meats, produce, and dairy products has been cutting retail store operating costs and also saving the consumer's time in the selection, purchase, and preparation of foods.

Development of packaging materials since 1928 has been truly spectacular—especially during the recent postwar years.

Has the curve of progress really only started to climb? Is the peak about to come into sight? What changes have been prime factors? In what phases and to what extent will new changes be made?

To answer all these questions, we will range the significant mileposts passed in the last 25 years—then venture to forecast trends within the next 25.



Points of progress are new and better materials.

Significant Current Trends

Highly significant is the present shift from rigid to low-cost, flexible-type packages. For example, concentrated fruit juices and sundae toppings are now appearing in polyethlene-cellophane pouches. And some packers of concentrated juices are eyeing the possibility of using a bag-in-carton package or a laminated foil pouch.

Packet-type thermoplastic papers now being used for packaging individual portions of sugar, salt, pepper, soluble coffee, and dried broth mixes will find new applications. The same portion-control, using a formed-vinyl package, is applied for jams and jellies.

Lard-packaging costs have been recently slashed with the use of plastic film-lined paperboard boxes or drums instead of metal containers. Other foods being bulk-packaged in this manner are vegetable shortening, condensed milk, pickle relish, and peeled potatoes. Polyethylene has also appeared as a liner for bulk-packaging similar foods in multi-wall paper bags. More recent is the arrival of saran-lined metal drums for packaging items in bulk.

Silicone-coated parchment is now preventing the sticking of products like cupcakes to the paper. More films and papers will be treated with antioxidants and mold inhibitors to curb deterioration of foods.

Development of packaging machines for handling such films as saran and cellulose acetate resulted in an extension of their uses.

Polyethylene-coated or laminated corrugated board has recently been made available. Properties of the plastic augment the natural strength of the board.

Stress on the protective features of shipping cases will continue. Notable is a gradual switch toward making shipments safer and less costly by using solid-flute corrugated board with new insulating and cushioning materials. Shipping cases and consumer-size cartons will be treated with acceptable repellents to protect packaged foodstuffs from insect and rodent attack.

Substituting for chipboard containers, low-cost kraft paper will be used more and more for bundling a dozen or more unit packages.

Improved laminating techniques will further extend the market for flexible packages as well as reduce their cost. These will include better methods of bonding papers, films, and foils with natural or synthetic laminates to offer a variety of combinations for solving many food-packaging problems.

To attract bargain-seekers, a modified form of bundling—the multiple package recently introduced for 5 and 10¢ candy bars and gum—is rapidly catching on. Just the opposite is the fractional package that features a number of small packaged units like cheese, crackers, and marshmallows put in consumer-size cartons. Other innerseal units will include 3 to 4 cupful bags of rice, brown sugar, and flour. Packaging in this manner is extending shelf-life of products—4½ times for nitrogen-packed dried cream and 3½ times for vacuum-packed fresh sliced bacon. Look for new resin-film combinations that will further extend the application of these plastics.

Development of new films with various mixtures of resins will provide a variety of protective features. Lower cost films will be produced by using extrusion techniques, base processes not requiring drying, and special solvents. Films, too, will be available with new properties by orientation rather than changing the chemical configura-

▸20,000 Tons of Tin Saved

▸Silicone-Coat Papers vs. Sticking

▸Glass Made 20-40% Lighter

tion of molecules. And new non-toxic plasticizers will improve them.

Various organic films will be applied to base sheets to supplement their properties. Selected coatings will increase heat sealability, grease-proofness, and resistance to water-vapor. Currently employed are polyethylene, vinyl polymers, cellulose derivatives, natural and synthetic rubber, protein resins, urea and melamine-formaldehyde, waxes, and natural resins.

The surface has only been scratched on the many modifications of resins and coatings, new resins, and methods of manufacturing to add to protective features.

Converting processes—printing, coating, and laminating—are common with most papers and films. By choosing proper materials and converting techniques, a vast number of packaging material combinations will be created for practically every flexible food-packaged need.

Newer coatings will be applied by hot-melt waxing, extrusion, and solvent techniques. Most common and inexpensive, at present, is the hot-melt application of paraffin—an easy-to-apply, moistureproof thermoplastic. To overcome some disadvantages of these wax coatings, there have recently been modifications with such additional thermoplastics as polyethylene, butyl rubber, and polyisobutylene. These additives have improved heat sealing, added gloss and scuff resistance, and provided greater flexibility of films or papers without impairing water-vapor permeability.

Solvent applied coatings comprise vinyl copolymers, polystyrene-butadiene copolymers, polyamides, urea formaldehyde, cyclicized rubber, and cellulose nitrate. While more expensive than wax types, they provide, in certain instances, better physical properties—particularly good moisture resistance.

Most recent development is paper coating by the extrusion method. Chief material now extruded on paper is polyethylene, with saran running second. Possible food-industry uses of these polyethylene or saran papers have only been scratched. Polyethylene applied to kraft paper, for example, makes a good frozen-food wrapper. Combined with foil-glassine sheets, extruded polyethylene affords excellent seals on high-speed lines.

Laminating two or more sheets is generally accomplished with adhesives applied in the molten state or from dispersions in water or organic solvents.

Taking Them One by One

Let us now trace the individual improvements and sum up what's likely to take place with the various packaging materials:

Metal Containers. Costly experience with hydrogen "springers" about 1928 resulted in the first chemical specifications for tinplate and marked the initial step in obtaining corrosion-resistant plate for longer shelf-life of products. This was achieved by decreasing the metalloid (silicon and phosphorus) content of the steel.

Economical production of low-metalloid hot-rolled steel was impossible until, in 1932, the cold-rolling technique was developed. But cans produced by this new method were soft, resulting in buckling and paneling—a problem soon overcome through introduction of temper classification, specified in metallurgical units.

Adverse influence of residual heavy metals in steel on corrosion resistance led to defining maximum amounts of each permitted in type L tinplate—another milestone. Too, these better steels laid the foundation for successful use of electrolytic plate, making it possible to insure an adequate food supply during the war.

Start of electrolytic deposition of tin on a production-wise basis in 1941 brought an average reduction of this metal-coating per base-box (of tinplate sheets) of 1.31 to 0.598 lb. in 1952. Tons of tin used for containers were slashed during this period from 46,900 to 27,772, while about eight billion more cans were made.

Successful packing of low-acid foods, that formerly caused objectionable can discoloration, was achieved by coating tinplate with zinc oxide-containing enamels. Other special enamels checked bleaching of colored fruits and vegetables.

Also, early success with C enamels (designated for their initial use with canned corn) spurred development of non-softening synthetic resins for thermal processed oily foods. Most outstanding enameling development, however, was for beer cans. It comprised the double application of synthetic base and vinylite top coatings to the cans.

Now, over 20 different linings are used to meet the requirements of different products. And research continues to adapt new synthetics for specific purposes. In fact, a new tinless can is now available for dry products. It consists of an organic coating and low-tin-bearing solder for the side seam. Special plastic cements may even replace this solder.

Latest is an easy-to-open, non-drip can. Dripless feature has been achieved by designing a turned-in lip to form the mouth of the nozzle that cuts off the flow of liquid after pouring. This can is ideal for "heavy-pouring" liquids like syrups, molasses, and edible oils.

Obviously, there will be increasing research on tinless—even going to plastic or aluminum containers for processed foods. In the offing for the pressurized metal containers using a food-dispensing propellent is extension from whipping cream to other products—sauces, mayonnaise, pancake batter, food colors, and flavors.

Glass Containers. Use of glass containers has expanded considerably because of the shift from cans dating from the outbreak of World War II. Production is now at capacity rate—with 45.8 million gross used last year by the food industry. And output will be raised to meet demand.

From a shipping and handling cost angle, research in the mid '30's on lighter glass containers resulted in a 20-40% weight savings. During the past few years, the weight of beer bottles dropped several ounces. Trend continues toward stronger lighter weight glass containers.

Direct printing on glass will be perfected to equal the quality of present printing on cans and collapsible tubes.

Problem on the discoloration of certain glass-packed foods has been licked. Use of silicon-treated jars to give a free-draining surface is in the offing for certain foods. Also, glass containers will be finding newer uses.

Folding Cartons. Less than half of the 200 styles of folding cartons are for foods. In 1928, they were chiefly used for dairy products, sugar, cereals, and crackers. Applications expanded with the appearance of frozen foods in the early '30's and of prepackaged produce since the war.

To compete with fully transparent bags "window-type" cartons have been designed to provide partial visibility. Some cartons are now wax-coated or impregnated to protect products from grease and water-vapor.

Future cartons will be better styled so appearance will be improved. Emphasis will be on improving protective properties with new materials for longer shelf-life of products coupled with ease of machine handling and lower cost. They will, for example, be coated with thermoplastic material for sealing at greater speeds.

Bag-in-Carton-Package. Early acceptance of this type package was by cereal manufacturers, and it was soon improved for other items needing protection from sifting and moisture. Bags now run the gamut of foil, cellophane, glassine, Pliofilm, parchment, krafts paper, and combinations of these sheets. Future bags for cartons will consist of better combinations of these materials and newer plastics.

Transparent Plastic Boxes. Attractive products like cookies, nuts, and candies are enhanced when put up in transparent display boxes made from vinyl and acetate sheets. Outstanding is the ease of fabricating these sheets to various shapes by heat-forming, bending and drawing, and creasing and cementing. Highly successful is the development of the extrusion technique, which will result in extended uses of these boxes.

Fiber and Composite Containers. Special containers are now being made to incorporate protection against grease and moisture by either winding the baseboard with cellophane, glassine, or parchment, or by combining the baseboard and these sheets with microcrystalline waxes. There is a trend toward polyethylene-coated paperboard because of its resistance to water, grease, and water-vapor. Here, too, future improvements will be in direction of using new materials to combine the advantage of rigidity and low cost. New applications are continually being developed for products not requiring hermetic sealing. These containers are also being equipped with easy opening and closing spouts.

Paper Containers. For water and greaseproof characteristics, these single- or double-wall containers are being made of pure sulfite or sulfate stock, sometimes treated with paraffin or vinyl plastic resin. Recently, those contained with transparent windows or tops have been finding increasing acceptance. Big demand for plastic-coated milk containers began in 1949, and more recently the twin-pack —two 1-qt containers bonded together—made its appearance. In the future, these will be improved by treating them with new lower-cost plastic resins.

The one-way paper milk container represents one of the most significant developments in retail merchandising during the past quarter century. An estimated 8½-billion single-service containers were used for 35% of all the milk sold last year. In many metropolitan areas, 50% of all the packaged milk consumed was put up in paper containers. About 12 years, ago, only 4.8% of beverage milk was so packed.

Aluminum Containers. Collapsible tubes are currently being used to a limited extent for cheese spreads and anchovy paste. Big problem is the need for better coatings to prevent pitting of the metal. And with their development, many corrosive foods like peanut butter, mayonnaise, dressing products, mustard, jams, and jellies will be packed in them.

Some foreign countries are now using aluminum cans for packing many thermal-processed foods, and research is continuing in this direction in this country.

Use of lightweight aluminum beer kegs, shipping drums, and bottles (for essential oils) has markedly increased since '40.

Labels. Paper has been the major material used for labels because it takes various finishes and is adaptable to different processes. Various combinations of paper and foil are now being widely used for their eye-appealing effects. More recently, thermoplastic labels—coated with plastic resins that can be heat-activated—are coming into widespread use on certain containers and wraps for bakery products, beverages, and prepackaged meats. Too, "all-around" labels of foil applied to paperboard canisters protect products from moisture. New thermoplastic formulations are being developed, with the result that cost of the labels will be materially reduced and they will find more and more applications.

Bags. A vast amount of materials is being used for bags, and the number of new types will increase considerably. Transparent materials such as cellophane, saran, polyethylene, clear glassine, and other plastic films, have become important for these flexible packages.

Laminated foil bags are providing protection against moisture, light, rancidity, and loss of flavor. Wet-strength kraft bags, treated with urea of melamine-formaldehyde resins, were developed soon after the war for moist products. A newcomer is the wet-strength glassine bag.

Fruits and vegetables are now being packed in bags providing protection, partial visibility, and air circulation. They comprise two or more layers of wet-strength kraft with a cotton-mesh window. Water-resistant adhesives for bags now permit the packaging of chilled beverages and potatoes.

Pouches. Many papers, films, and laminations are now being employed to package and protect products. Foil and wax-laminated glassine are being used to prevent caking of beverage powders. They are also used for soup mixes and other food concentrates. More recent is the appearance of a glassine, polyethylene, and foil combination.

Trend toward packaging individual-servings of soluble coffee, seasonings, broth mixes, and others, is increasing the consumption of these items since this practice provides consumer convenience.

See New Economies

Development of lower-cost flexible sheets and faster machines will enable processors to turn out unit packages for individual servings as economically as the packing in large size rigid containers. For example, putting up 28 packets of soluble coffee may be as economical as packaging the same amount of servings in a can or glass jar.

Polythylene-cellophane pouches are being adapted for liquid foods. They safeguard flavor and color and resist puncturing. For products needing protection against water-vapor penetration, there are vinyl resin films, foil acetate laminations, and other combinations of materials. The newer polyethylene-coated kraft paper pouch is a natural for frozen food because of its high wet strength and low-temperature flexibility. Pliofilm, saran, and other water-tight films opened a new type of retail distribution of oysters, pickles, sauces, and brined kraut.

Papers. Now, papers are perfected for proofness to water, water-vapor, grease, gas, and insect penetration. For example, laminated kraft paper resists puncturing and tearing; polyethylene-coated kraft and treated glassines are impermeable to water; and special wax-paper overwraps for frozen foods are no longer brittle. Moistureproof papers are coated or impregnated with microcrystalline waxes, new resins, wax blends, and asphaltic or rubber blends. Parchment, glassine, and kraft paper are treated with these compounds.

Other laminants combine paper with plastics, rubber

Plastic Films Offer New Packaging Opportunities

Benefits Boost Resin Adhesives

and regenerated cellulose, or foil. For additional protection, complex combinations of paper, films, or foils are used. Progress is underway to improve the waterproofness of single-ply kraft paper by impregnating it with resins, waxes, rubber, and various blends.

Parchment. This was the first paper with high wet-strength and resistance to grease penetration. It is widely used as a wrapper for moist and fatty foods. Now several hundred types of vegetable parchment are custom-made to fit a wide range of applications.

Newly developed are silicone-treated parchments with "release" or anti-sticking properties. Also parchment with anti-creeping properties is preventing the spreading of oils. Releasing-type parchment is being used for lining boxes for brown-'n-serve rolls. Interleaving sheets are employed for frozen cut meats.

Waxed papers. For certain applications of coated or laminated papers, resins or latex are added to waxes to provide greater low-temperature flexibility, better sealing, and superior moisture impermeability. Important is the recent addition of polyethylene to waxed paper used for bakery and frozen food products.

Resin-Coated Papers. Economical are the polyethylene-coated papers when used in place of heavy-gage, unsupported films. Advantage of coating over laminating is that a thinner film can be used with better adherence to the backing material. Such papers are finding uses for packaging fresh produce and dried milk in bulk.

Newcomer is saran-coated paper. Pouches made from this sheet seal well, resist grease and water-vapor permeation. These papers are now being used as cap liners and for packaging dairy products, frozen foods, and dehydrated items.

Cellophane. Old standby that continues to find more food uses is cellophane. Properties of this film can be readily varied according to the composition of the lacquer coating. Notable is the alteration of the film's heat-sealing properties and moistureproofness by this technique. It's properties, too, can be supplemented by laminating it to other films.

Advantages of a cellophane-polyethylene sheet, for example, are extra strong heat seals, good machine performance, improved durability, and low gas permeability. The latter makes it possible to pull a vacuum as in packaging sliced luncheon meats, or to package such products as nuts in inert gases.

Cellulose Acetate. Techniques have recently been devised for heat-sealing this film. Because of its clarity and stability, acetate film is laminated to foil or paper. The acetate-foil combination produces an excellent moisture-proof, durable, sparkling package with a superior printing surface. It is used for hygroscopic foods like dried yeast, soluble coffee, dried milk, and dehydrated soups. The acetate-paper combination is principally used for labels.

Pliofilm. Properties of this film have been altered by plasticizing with heat and stretching. It can thus be made stronger and will shrink around products with application of little heat. By laminating Pliofilm with other materials, its food packaging applications have been further extended.

Saran. Combining high bursting and tensile strength, this sparkling transparent film provides excellent sealing properties that provide a liquid-tight seal for moist products like oysters, pickles, and olives. It is used on sausage stuffing equipment, bag-making machines, and electronic and belt-type heat sealers.

Polyethylene. This film is finding increasing applications because of its low cost and excellent protective properties. Many developments are underway using polyethylene for packaging produce and other foods. Notable has been the increase in the amount of this film used for packaging.

For example, approximately a 260% increase in the pounds of "poly" for all types of packaging has occurred during the past 3 years. And packaging consumption of this material will, it is estimated, go up another 365% within the next 3 years, with the cost being competitive with cellophane. Today, about 35,000,000 lb. are used in the food industry, and this figure should jump to 100,000,000 lb. within the next half decade.

Also polyethylene squeeze bottles should find a place in the food industry.

Vinyls. The variety of vinyl films is almost never-ending. They are made with vinyl chloride alone or in combination with vinyl acetate, together with different plasticizers. Production has recently expanded, and with improvements it might become competitive with cellophane.

Looming as an economical substitute for metal tubes is a vinyl plastic collapsible tube. Eliminated will be the problem of tubes bursting from careless handling or from product expansion due to temperature changes.

Vinyl-Rubber Film. Variations in composition of this film can be achieved by combining it with vinyl chloride and Buna N synthetic rubber.

Foil. Uses for aluminum foil in food packaging have greatly increased since 1947, and production of this metal is keeping pace with demand. The old low bursting and tear strength, pinholes, and non-sealing properties have been overcome through the development of various foil combinations—films, waxes, papers, and heat-sealing coatings.

New Plastic Films. Yet to be investigated as possible food wrappers are polyester and polystyrene films. One of the former, trademarked "Mylar", is a condensation polymer obtained from ethylene glycol and terephthalic acid. It is reported as sparkling, transparent, and durable. The latter is also transparent, and it is rated between cellophane and cellulose acetate in gas permeability.

Adhesives. To meet specific needs, new adhesives are being brought out and old ones are being improved. Included are animal and vegetable adhesives, resin emulsions, lacquers, hot melts, thermoplastics, and casein.

It is reported that synthetic resins within 5 years will account for 80% of the total adhesives. Last year, approximately 40% of the adhesives consisted of these resins. Chief resin used is polyvinyl acetate. Others include polyvinyl chloride, zein, casein, acrylates, polystyrene, and the cellulosics. While synthetic-based resins are more expensive initially than animal and vegetable types, additional cost is compensated by their superior qualities, stability, convenience, and adaptability to high-speed machinery. Use of delayed-tack adhesives, for example, permits bottle labelers to operate at speeds of 300 instead of about 60 per minute.

Lacquers comprise cellulose derivatives, chlorinated or cyclized rubber, resins, and plasticizers in solvents either alone or mixed.

Alkaline-modified starch products have largely replaced dextrines for labeling, since they adhere well to glass. Also they aren't sensitive to wide extremes of atmospheric conditions, resist moisture (though they are not waterproof), and are not easily diluted.

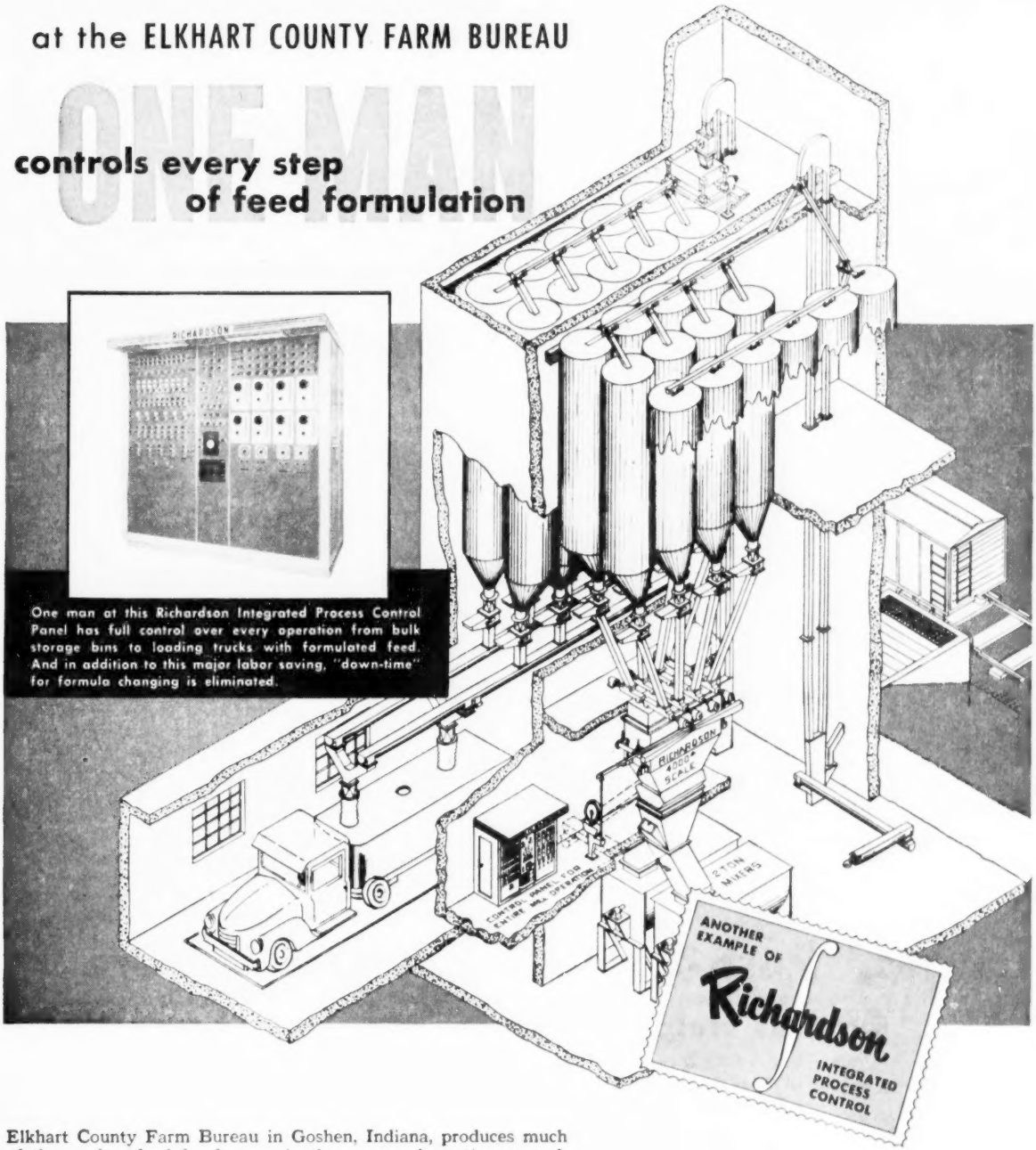
Hot melts comprise waxes, resins, plasticizers, and modifying ingredients that are combined with heat. They are used where fast speed and high solids are required without solvent action.

Fiber Boxes. Now employed are solid and corrugated boxes fabricated by combining a number of paperboard sheets with special structural characteristics designed to

(Turn to page 196)

at the ELKHART COUNTY FARM BUREAU

ONE MAN controls every step of feed formulation



One man at this Richardson Integrated Process Control Panel has full control over every operation from bulk storage bins to loading trucks with formulated feed. And in addition to this major labor saving, "down-time" for formula changing is eliminated.

Elkhart County Farm Bureau in Goshen, Indiana, produces much of the poultry feed for farmers in the county. A continuous task of volume supply, but a task considerably lightened by this recently installed system for complete formulation control.

Feed formulation is now a relatively simple procedure. Integration and sequence of all operations are quickly accomplished by remote *automatic control*. Production rates up to 60 tons per hour* are possible, using accurate individual discharges up to 4000 lb. In addition to allowing storage of grain purchased at favorable market prices, installation design also permits transfer of feed ingredients by remote control from any one bin to any other bin—or into formulation.

Complete systems for integrated process control are natural results of Richardson's fifty years' experience. Perhaps your feed formulation, too, could be improved for greater efficiency and savings. At no obligation our engineers will gladly survey your present installation and show you how Richardson Integrated Process Control can make your operation more profitable.

* Drawing shows 2 mixers giving 20 tons per hour total.

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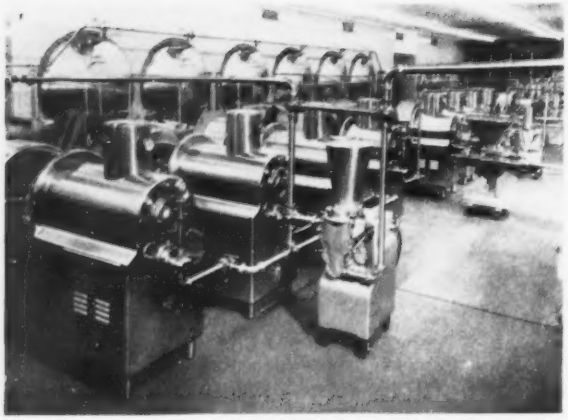
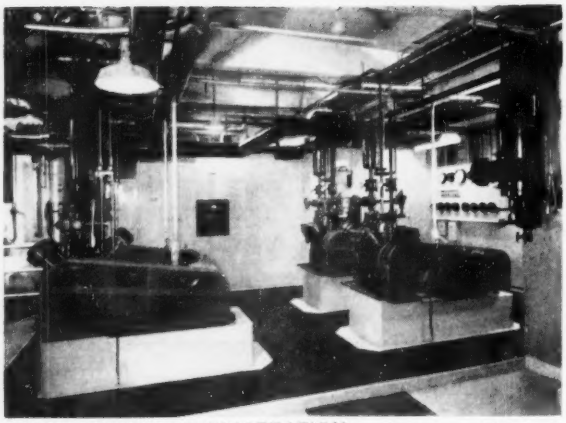
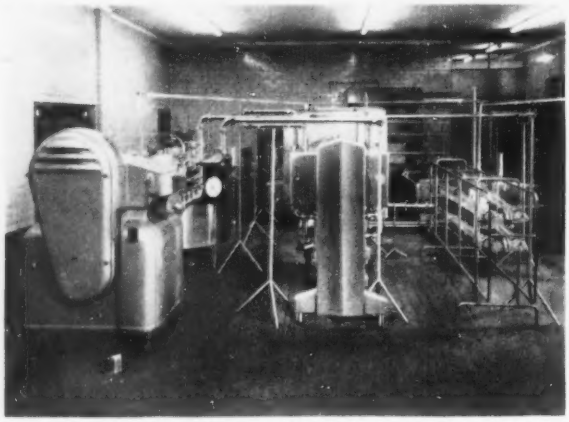


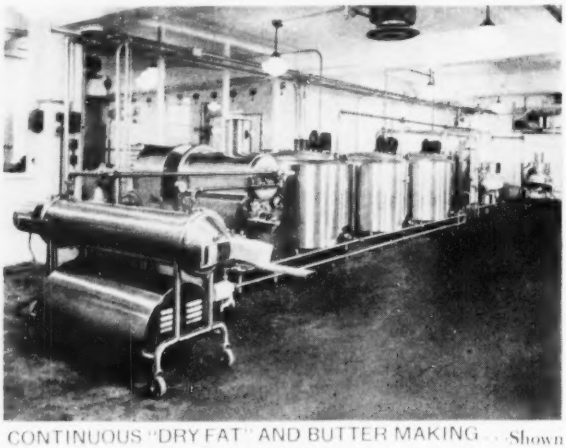
"PUSH-BUTTON" ICE CREAM PRODUCTION—Thirteen CP Continuous Freezers and Fruit Feeders supply 2800 gallons of ice cream an hour directly to packages, bulk containers or novelty processing line.



"PUSH-BUTTON" REFRIGERATION—In this large cold storage warehouse, CP Ammonia Compressors and Boosters automatically provide widely varying temperatures for different storage needs.



"PUSH-BUTTON" MIXING, BLENDING, HOMOGENIZING AND PASTEURIZING OF "MIX" INGREDIENTS—CP Blending and Mixing equipment in the background; CP Homogenizer and Stainless Steel H. T. S. T. Continuous Plate-type Pasteurizer in foreground.



CONTINUOUS "DRY FAT" AND BUTTER MAKING—Shown here is typical CP straight-line continuous production of sweet cream butter. CP Chiller is equally effective for many viscous products.

Yes," Push-Button" Plants Are Here

CP Has Helped Engineer Many of Them

The dairy industry was one of the first to realize the production economies and product quality improvement to be had from "automatic" continuous processing and handling.

In many of these continuous systems, whole series and sequences of operations are controlled by push-buttons. Such functions as weighing—blending—mixing—homogenizing—pasteurizing—cooling—freezing and refrigeration are all handled with minimum supervision. Best of all, quality and uniformity of product are both better, because of it.

Creamery Package has pioneered in the planning, engineering and installation of some of the most outstanding continuous systems. CP's broad knowledge and variety of equipment can help other food processors *now*—as they plan their "push-button" plants for more profitable and efficient operations *tomorrow*.

If you are one of these progressive processors, ask to have a CP Engineer sit in with you. A line on your letterhead will arrange it.

Self-Contained MilKeeper Refrigerated Tank

for bulk cooling of special products. Can be furnished on casters for portable plug-in operation.

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HEAT TRANSFER

OF ALL THE MANY unit operations spelling successful food manufacture, heat application probably comes closest to being the most basic and universal in importance.

And because of what appears to be a virtual renaissance in food thermodynamics, now, more than ever, it behooves the alert food processor to take objective stock of how he applies heat in his plant—for antiquated thermal engineering today can easily lead to extinction tomorrow.

There were obvious signs that the thermal inadquacy of "batching" was under critical scrutiny 25 years ago. True, cooking was still pretty much confined to kettles, vats, and still retorts. But traveling hearth ovens had appeared in most large bakeries and a barrel-type continuous heater was making its first hesitant appearance in cheese processing plants.

Cooking in batch, was slow, and to increase speed of heat transfer an attendant often wielded a paddle. Small mechanical stirrers started to replace this manual agitation in the early '30s.

Build-up on production kettle was particularly a problem in cooking viscous foods. Jackets for steam and water were added on these vessels and side scraping agitators adopted. In chocolate melting this improvement cut the time almost in half.

One problem in using saturated steam was the large amount of condensate which required trapping to atmosphere. Its intermittent drainage periodically reduced cooking temperature to 212 deg. F.

In 1940 a New Jersey tomato processor put in a high-pressure condensate return system to get away from periodic trap draining. Pumps and a collecting manifold drew 140 psi. condensate from cooking coils as it formed, returning this 360 deg. F. water to the boiler.

By this method cooking time was actually reduced over 50%—from a former 15 min. to 7 min. per batch. Further, the substantial reclaim of heat was estimated to save about 15% of fuel costs.

Retorting Upgraded

Still retorts—both steam and water batch types—were being scientifically used for sterilizing food in sealed cans in those days. However, subsequent heat-engineering studies did much to develop steam spreader systems and air venting of these vessels. This cut down the "come-up" time and it greatly improved thermal efficiency during process.

But still retorting lacked a basic virtue for really efficient heat-transfer. There was no movement of product over the transfer surface. This necessitated long cooks at relatively low temperature to reach the center of the can without damaging outer layers of food.

An obvious answer was to agitate food in the cans during process. In the mid-'20s an agitating pressure retort greatly improved canned evaporated milk with a 240 deg. F., 15 min. process. Essentially, this was a horizontal pressure shell with a spiral can carrier that rotated during the heating cycle.

Points of progress are the new uses of continuous rotary-scraper heat exchanger.

It is interesting to note that an agitating cooker which turns the cans end-over-end has only recently been applied to other canned foods, with striking reduction in process time and improvement in flavor and color. It is able to process a 307x409 can of vacuum packed peas, for example, in 4.9 min. at 260 deg. F., as against a former standard still cook of 35 min. at 240 deg. F.

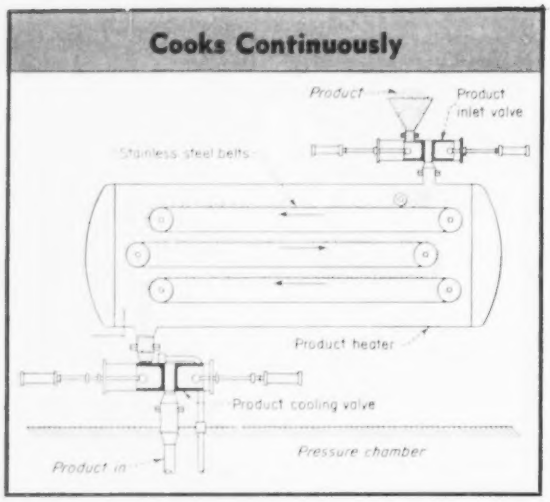
On the Move

However, before the value of short-high cooking became plain to the industry, there was a concerted move to mechanize the batch.

Acid canned foods, of course, could be continuously moved through a boiling water bath. But in the late '20s a true continuous pressure cooker was introduced. This employed a valving system to introduce cans into a horizontal rotating pressure chamber where a helical track moved them, in given time, through to a similar valve for discharge and cooling.

The new continuous pressure cooker established true convective heating of canned foods, and its countercurrent flow of steam to product gave high thermal efficiency.

An integrated pressure-cooling section was an early addition to this unit. One typical assembly of this type was installed in 1928 in a Brooklyn dog food plant. It handled 100 cans a minute for a 20 min. cook—an unbelievable 2,000 cans-per-hour capacity.



HI-TEMP, short-time belt cooker for viscous foods.

Eight still retorts were eliminated, yet production was doubled and direct labor was cut from ten to only three attendants. Less steam was used, and almost four times the number of cans were processed per square foot of heating surface.

In the past several years this cooker has developed to withstand higher steam pressure, thus affording even shorter, quality conserving processes. It has been applied to pureed and whole vegetables, such as corn, peas, and various meat products.

Last canning season the newest version of this cooker extended the gains of continuous high-short pressure cooking into highly viscous products such as cream-style corn. It reduced the processing time of 303 x 406 cans of cream-style corn to 18 min.—and at 250 cans per minute.

"Continuous" Kettle

While in-can sterilization was moving forward, a parallel series of improvements in thermal processing of uncontained food products was taking place.

There appeared a zealous determination to overcome the batch limitations of kettle cooking. In 1929, a continuous tapioca cooker was described which could process 2,500 lb. of the product per hour. This consisted of a series of cascading, automatically tilted jacketed kettles with stirrers.

In the '30s logical engineering joined this multiplicity of jacketed kettle surfaces into an extended vessel with either a pitch or a screw conveyor to move the product along—a true "continuous" kettle.

A natural adaptation of this approach was the use of a jacketed, hollow screw conveyor for continuous blanching of fruits ahead of juice and nectar lines. Steam and water was used for heating; stainless steel and sanitary construction was developed; and units as high as 24 in. and 30 ft. long were employed in a variety of blanching, cooling, and heating operations.

More recently, a new version of this conveyor-processor has appeared with hollow, counter-rotating intermeshing screws that mix as well as heat the product in transit. This apparatus can be arranged in space saving tiers, and has been used to concentrate sugar syrups, pre-heat baby foods, and process cottonseed cake.

Some highly significant developments in thermal processing of liquid foods also took place in America in the late '20s.

At that time continuous heat-exchanger was announced for "flash" pasteurizing milk for cheese at 160 deg. F. Profound gains over the accepted vat method of heating were offered—greater throughput, positive temperature control, remarkably advanced thermal efficiency.

Essentially, this early equipment consisted of a series of tubes for carrying the pumped product through a water —later steam—jacket. However, immediate and widespread use of the principle was limited because of inadequate knowledge of such things as specific heat, viscosity, and thermal conductivity of various foods—highly pertinent facts in manipulation and design of such high-volume heating units.

Since milk had been much researched, dairy equipment firms were quick in developing similar continuous heaters. In '28 a five unit, tube-in-tube continuous milk preheater and holder utilizing steam was installed in a number of plants for the "short-time" pasteurization of milk.

Soon other liquid foods—particularly fruit juices—succumbed to the benefits of continuous heating. In '33, USDA workers described an experimental heating tube coiled in a steam jacket which effectively sterilized citrus juice at 190 deg. F. at 400 gal. per hour. Its 1-in. tubes were made of stainless metal and flattened to increase the speed of heat transfer.

Just two years later a shell-and-tube type heat-exchanger was offered commercially by an equipment firm for preheating tomatoes prior to evaporation.

Though initially developed for simple preheating and pasteurizing, the new tubular unit was found capable of almost instant heating of fruit and vegetable juices to complete sterilizing temperatures of 250 deg. F. or above. This, followed by some cooling in a similar heat-exchanger, would permit hot-filling and sealing of containers without need for subsequent retorting.

Implications of continuous sterilization were quite exciting. One small exchanger, occupying less than 10 sq. ft. of floor space, could process around 8,000 quart cans per hour. Under control of one attendant, this was equal to a six retort cookroom employing at least three workers. And the "flash" process product had superior flavor to boot!

Plates Appear

While early continuous heat-exchangers for food were primarily of the tubular type in this country, an interesting new approach—the plate unit—was being perfected in England and Europe.

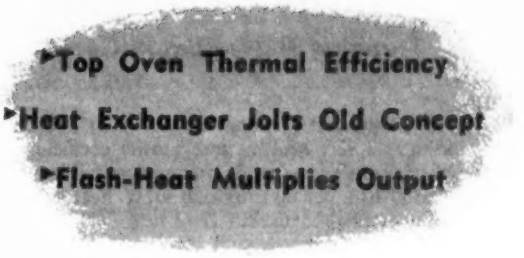
A well known English design, which appeared here in the early '30s, employed a series of flat grooved plates pressed together with joining gaskets on a frame. Product was pumped into the unit to flow in the grooves across one-half the plates while cooling or heating medium is circulating countercurrent on alternate sides.

Because of its countercurrent flow and the large exchange area offered by shallow-grooved plates, heat exchange in this type unit is very efficient and rapid.

While plate heaters were also employed for cooling wort, and heating yeast, molasses, and oil on the Continent, their early use in America was primarily confined to milk and milk products. In fact, it might be said that the plate heater has revolutionized dairy processing in America, since commercial high-temperature short-time pasteurization was made possible by, and has been primarily confined to, this equipment. One virtue of the continuous heater exchanger which spurred its use in dairies was its ability to conserve heat by regenerative exchange.

Since the war, plate heat exchangers have vastly broadened in application. They have been used to pasteurize wine and juice, and recently they have proved ideal for continuous cooking of starch in salad dressing manufacture.

Because of their inherent design, plate units have been pretty much confined to temperature applications below 250 deg. F., or 15-20 lb. hot water pressure. Further, steam for heating has not been extensively used because of condensation removal problems. However, this heating medium has been used in some installations quite successfully, and working pressures up to 120 psi have recently been announced.



Scraped-Surface

Concurrent with efforts to develop a "continuous" kettle for viscous foods and efficient controllable continuous heaters for liquids, a significant development took place in the late '20's which seemed almost to weld the two concepts.

A basic patent was taken out at that time for the continuous freezing of ice cream. Employed was a jacketed cylinder-like unit with an internal rotating shaft bearing scraper blades to keep its heat-transfer surface free of product.

Basically, the unit seemed to have all the merits of an ideal convection-conduction heat-exchanger. Its transfer surface was relatively large, with product retained small in amount. And the scraper mechanism was found to not only agitate, but greatly reduce the laminar film so resistant to fast heat exchange.

After this freezer's notable success in the early 30's, use of its same heat-exchange principle was suggested for processing of fats and oils. Continuous plasticizing subsequently provided striking gains in the structure, consistency, and baking qualities of commercial shortening.

In the mid-'30's a similar basic advance occurred when the unit was adapted as the "heart" of a new continuous margarine process. Here, besides a similar product upgrading, it established tremendous operating economies.

By the '40's the same basic apparatus was launched into continuous processing of such foods as peanut butter, cake batter, edible starch for salad dressing, concentrated fruit juice, purees, and pulps. Also, various dairy products such as plastic cream, sweetened condensed milk, ice cream mix, and chocolate milk. Applications also appeared in the processing of cheese, gelatin, and baby foods.

It is significant to note how this basic apparatus broadened not only in products handled, but in functional usage. It augmented and blended its straight heat-transfer function with such operations as mixing, emulsifying, and aerating. These simultantous abilities, plus its high heat-transfer efficiency and controllability, seemed to add up to a one unit "process-innovator" rather than a simple heater.

Process Innovation

Latest triumph of the scraping-type continuous heat-exchanger—the new continuous starch jelly process—is an excellent example of how advanced thermal engineering and a necessary objective approach can completely shake up established concepts.

Starch jellies have long been one of the confectioner's toughest products. A tedious kettle cook is needed because of the large amounts of water necessary to complete starch gelatinization. And during this cook even slight changes have profound effect upon subsequent clarity, gel, and viscosity. Hence an abnormal amount of supervision is required.

To the engineers it was simply a matter of cooking a concentrated starch-sugar slurry, then adding ingredients and depositing.

The concept proved highly feasible. Starch cooking is now at a continuous 285 deg. F., followed by instant cooling—and at 2,500 lb. per hour. Amount of depositing starch needed is less, setting time is reduced. Also there's better sanitation, and uncomfortable hot rooms have been eliminated. And, best of all, the new uniform jelly excels in quality.

The dollars-and-cents story is even more striking. In a typical operation it is estimated that the process eliminates seven cooking kettles and reduces molding starch needed from 455,000 to 182,000 lb. Starch trays required are reduced from 35,000 to 14,000. And savings, including capital outlay costs, are calculated to run $6.02 per thousand pounds production.

High Velocity

Other highly promising heat-exchange units have been developed in the past 15 years. These employ high product velocity to defeat inefficient film formation on heating surface.

In the early '40's a unit employing two ¾-in tubes, 63 ft. long and coiled within a compact steam jacket, was developed for flash heating citrus products. A 20 hp. motor was used to drive 1,800 gal. of product through these tubes at 2,000 ft. per minute to provide an exceptional overall heat transfer rate, or *k*, of 1200.

The high turbulence developed in this heater made it possible to raise fruit juices from 100 to 300 deg. F. in a single 2-sec. pass. And its capacity, again because of high velocity, was equal to the through-put of about eight, three-basket retorts—despite the tiny quantity of product retained in its system at any instant.

A few years later, government dairy scientists came up with a unique high-velocity heater designed for high-temperature processing. This design was very compact, consisting of an outer steam-jacketed housing and a tapered hollow insert core with a closely-machined helical passage. The product was forced through this narrow, annular swirling path under high pressure, steam being applied through two enclosing surfaces.

One of the first to employ the design was a West Coast dairy aseptically canning milk by the Martin process. The heater was able to raise 125 deg. F. milk to 285 deg. F. at 500 gph. Its spiral grooves were ⅜ in., and product was pumped at 200 lb. pressure.

Additional advantage of this core-in-shell heat exchanger is its ease of cleaning.

Another new continuous high-velocity heater recently perfected employs a horizontal removable insert core with a spiral factor to induce product swirl. Adapting this heater to a new product simply involves re-inserting a new core element with the needed spiral pitch. This heater is equipped with integrated instrumentation, including a carefully sized steam control valve and an oversized valve operator. Further, it has an improved system for continuous removal of condensate and non-condensable vapors throughout a range of 14 in. vacuum up to 130 lb. working pressure. The condensate can be utilized to desuperheat incoming steam when necessary.

When sterilizing a milk-base infant food formula in a Michigan plant, a twin-barrelled unit was able to heat

12,000 lb. of product per hour from 165 to 270 deg. F. This indicates a very healthy heat-transfer coefficient, and actual calculations on ice cream mix proved it able to transfer 1,600,300 Btu. per hour in a 20 sq. ft. heating surface, providing a thermal coefficient *U* of near 700.

Other Approaches

In 1929, a basic patent for direct steam-jet sterilization was issued. This involved a stirrer-equipped continuous heating cylinder, with nozzles in the stirrer shaft for injecting dry steam into the product.

First application of this apparatus was by a condensed milk company for sterilizing many of its products. In subsequent years, patents were issued for steam-injection sterilizing ice cream mix, grape juice, orange juice, and soup.

Also in the '30's this principle of direct steam injection—this time under vacuum—was perfected in New Zealand for cream pasteurization. This unit was subsequently brought to this country and has been installed in hundreds of creameries.

Essentially, it injects dry saturated steam into the sprayed product under about 6-8 in. of vacuum, and this excess moisture is subsequently removed in a vacuum cooler. Immediate "flash" heating, with product temperatures as high as 200 deg. F. at 15,000 lb. per hour, are thus achieved.

Vacuum steam pasteurizers have been used on ice cream mix, cheese, homogenized milk and, most recently, margarine culture. The technique certainly bears investigation as to possibilities with other food products.

In 1935, immersion type heaters were reported to be directly heating cooking oil in continuous deep-fat frying baths. These, however, were gas fired and consisted of venturi type burners that ejected gas and air mixtures into submerged tubes. The new method of heating was easier to control than under-vessel firing and saved from 25-40% of fuel costs.

Recently, installations have been made where deep-frying oil is heated by continuous circulation through Dowtherm heat-exchangers. Control is claimed to be even more precise.

Submerged combustion—where a gaseous fuel is burned completely immersed in the liquid, with gases discharging directly—was successfully tried in the evaporation of citrus molasses in 1948. This was calculated to raise heat release from the former 30-50,000 Btu. per cu. ft. per hour, with fire-boxes, to 4-5 million Btu. One processor has designed a continuous conveyor-cooker that passes the canned product through organic-fluid, vapor at well over 300 deg. F. With agitation in transit, a high-short process results.

Electronic Cooking

One of the first commercial high-short pasteurizers passed milk between carbon electrodes, heating the milk to 161 deg. F. in its 10-sec. passage.

In 1944 a patent was filed to improve on the shortcomings of carbon electrodes by utilizing radio-frequency current. Here, the electrodes were simply three metal bands arranged around a small-diameter pipe which carried the milk. Almost instant heating to 205 deg. F. was claimed, with an energy output equivalent to 1 kw. per 25.2 qt. This cost, however, was about double that of resistance heating.

Recently, another patent along the same line has been granted, but the new method attempts to introduce higher efficiency by regenerating the incoming milk against the water which is used to cool the large oscillating tubes necessary to produce high-frequency energy.

Radar developments during the war created yet another approach to electronic heating of foods—subjecting the product to super-high frequency. Molecular friction in the food caused a uniform heating effect and some interesting results in the cooked product.

Costs of this dielectric cooking as compared to conventional heating medium are high. Hence, the technique thus far has been confined to compact installations for thawing frozen meals in transport and specialty cooking in restaurants.

Conductive products have been subjected to inductive heating—placed inside a high-frequency coil. Meats, with their high salt content, readily adapted to this technique, with sausage, for example, completely baked in 90 sec.

(Turn to page 248)

Trends to Tomorrow

Despite the striking pace of improved food heat-technology, it is difficult to foresee major revolutionary changes in the way foods will be heated in the quarter century that lies ahead.

Recently developed for chop-suey, the continuous metal belt cooker bids fair to apply to large discrete foods. Food cooked in this manner will be valved into an above-atmospheric room for aseptic filling into containers.

Steam will continue to dominate as a low cost, highly flexible heat-exchange medium. However, non-toxic high-temperature organic heat-transfer fluids will be developed for continuous cooking above 300 deg. F. at atmospheric pressure. This technique will apply to continuous evaporation—such as in candy and preserve making—and will permit use of inexpensively constructed, safe, low-pressure equipment.

High-pressure water above 212 deg. F. will also be utilized, particularly in plate heaters. Generating systems to produce this "superheated" water have already found wide use in Belgium, England, and Switzerland.

Electrical power will resurge as a means for heating foods if it drops in relative cost. Also, as less costly electronic equipment is developed, the high initial cost of the electronic processing will be obviated. Then such techniques as high-frequency heat melting, cooking, thawing, de-infesting, and roasting will become more widespread.

Processor—Take Note!

One thing is certain. Heat exchange is a tangible processing operation which, if improved objectively and progressively, can do much to insure operating economy and better products.

How then upgrade the present and organize for the future?

Be sure to have on hand engineer-trained personnel capable of working with basic heat-transfer theory.

Next a complete project must be started by these engineers to study the thermal efficiency, or heat-balance, of every process in your plant. With this basic data, you are in a position to make concerted improvement in relieving the debit side of your heat balance.

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- **Strength at High Temperatures**
- **Resistance to Oxidation at High Temperatures**
- **Ease of Fabrication**

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302	309S	316Cb	330	410
302B	309Cb	317	347	430
304	310	321	403	443
308	314	329	405	446
309	316	INCONEL * — NICHROME **		

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Globe seamless stainless steel tubing may be had in sizes from ½ inch to 6 inches O.D., and in pipe sizes ⅛ inch to 6 inches, standard, extra strong and double extra strong weights.

Gloweld electric welded stainless steel tubing is available in sizes ranging from ¼ inch to 5 inches O.D. inclusive; in standard weight pipe (schedule 40) sizes ⅛ inch to 2 inches — lightweight pipe (schedule 5 and 10) ⅛ inch to 4½ inches inclusive.

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Precision checks — and re-checks — at every stage of production insure Globe stainless steel tubes that meet *your* exacting specifications. For more than thirty years, specialization in production of steel tubes has key-noted all Globe research, engineering and mill operations. Write for the Globe Stainless Steel Tubes catalog.

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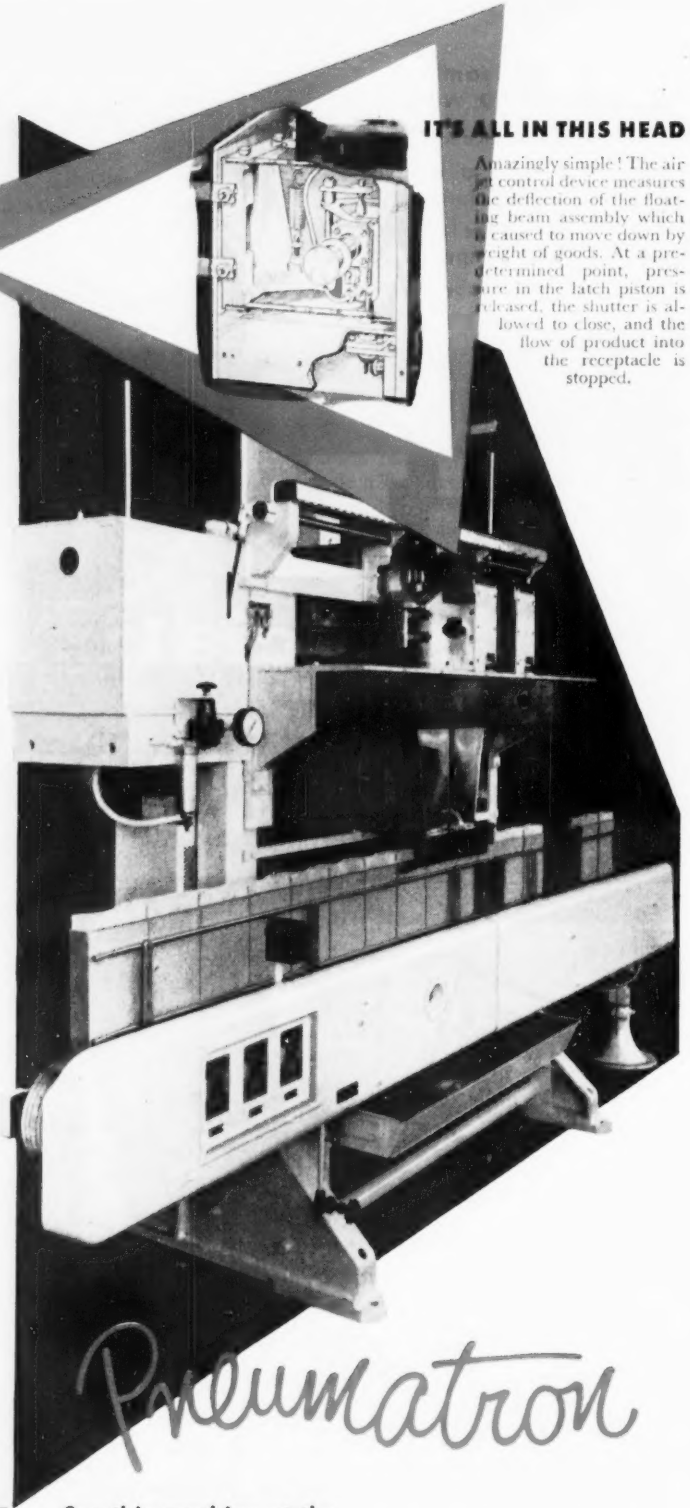
SPEED — More than twice as fast, two head units may be used to do the work previously done by four.

ACCURACY — Compared to conventional methods Pneumatron's phenomenal accuracy and reliability keeps overweight "give-away" to a negligible minimum, thereby saving thousands of dollars per year.

CONSISTENCY — Weights hold to the line day in and day out — repeated adjustments are unnecessary, just set the heads once and forget them!

SIMPLICITY — No electronics or delicate trip mechanisms.

That, in brief, is Pneumatron. For further details on speed, floor plans, weight accuracy charts and overall performance, send for Bulletin 122. PNEUMATIC SCALE CORPORATION, LTD., 91 Newport Avenue, Quincy 71, Mass. *Also: New York; Chicago; San Francisco; Los Angeles; Seattle; Leeds, England.*



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Packaging and Bottling Equipment

REFRIGERATION

MOST OF THE OUTSTANDING advances made in the use of mechanical refrigeration in the food industry have occurred since 1928.

It was approximately at this time that refrigeration, as an art, was combined with technical skill in food processing. And a quarter-century of achievement has resulted in the development and refinement of refrigeration applications in nearly every kind of food processing plant.

Compressors

"The heart of a refrigeration system"—the compressor—has undergone a spectacular engineering transition. The trend in design has been toward higher rpm. to reduce the weight of these machines. Each increase in speed has reduced the displacement required by each cylinder stroke and consequently reduced the size of the unit.

In 1928, the heavy compressors needed special foundations and considerable space for operating and necessary repair facilities. As an example, a 10x10 in. 2-cylinder, 360-rpm. compressor, powered by a 125 hp. motor and developing 80 tons of refrigeration, weighed 16,000 lb. It required a minimum of 10-ft. headroom and occupied about 10x5x7 ft., plus 4 ft. for bearing removal.

Now take the V/W multiple cylinder compressors, developed in 1938. A 16-cylinder V/W unit operating at 1,200 rpm., powered by a 125 hp. motor and developing 78 tons of refrigeration weighs only 7,000 lb. It requires but 9x3¼x5 ft. operating space.

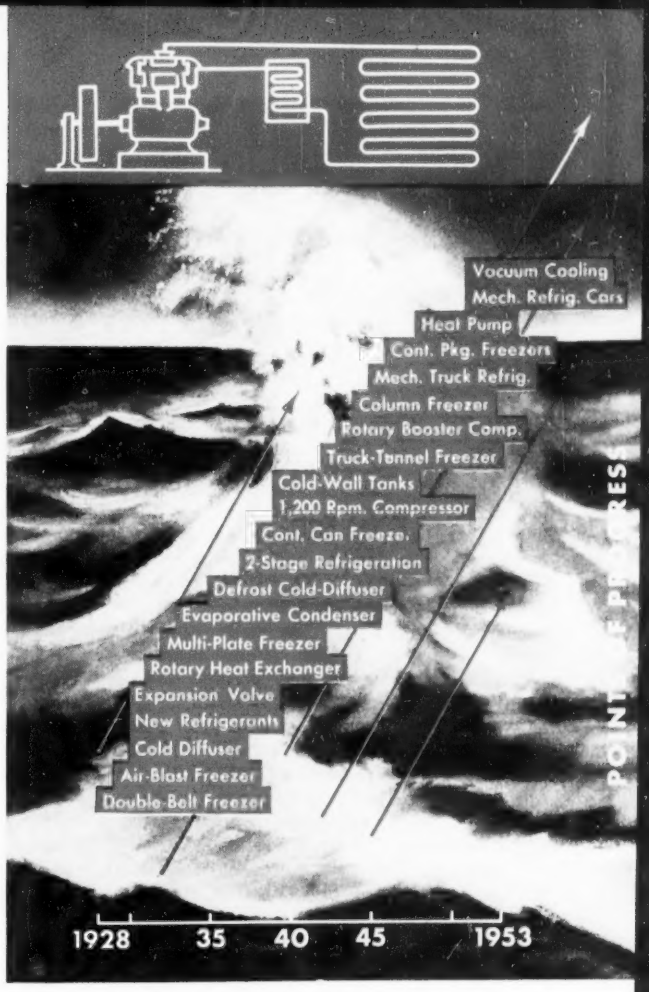
This advance in compressor design lowers initial cost by reducing installation expense—compressing the space required. Such lightweight units may now be safely installed on upper floors of plants.

Two-stage compression was developed successfully prior to 1928, but it did not come into broad use until this period. The increasing demands made by food freezers and those by the military during World War II, were the major incentives for lower evaporator temperatures.

Although reciprocating compressors are used for two-stage work, the use of rotary compressors, where the displacement is large and both compression ratio and discharge pressure are low, is becoming popular. Where temperatures of −20 deg. F. are required, the use of multi-stage compression is necessary.

These booster systems provide lower temperatures or more refrigeration capacity with less connected hp. than would be used with the single-stage reciprocating compressor. When combined with a booster unit, high-stage equipment requires less maintenance and its operating life is extended because it no longer is forced to operate under extreme conditions.

Large centrifugal turbo-compressors, complete package-type refrigeration units, have gradually been adapted to food processing. Used for the low-temperature concentration of orange juice, they act as heat pumps and provide water, from the condenser, at 90 deg. F. as a heating medium for the first vacuum effect. The evaporator cools water to 37 deg. F. for the barometric condenser.



Points of progress are significant advances in refrigeration and new applications.

The first four-stage centrifugal turbo-compressor (294 tons refrigeration) to be used for vegetable quick-freezing was installed in 1950 in a Northwest pea freezing plant. Rated daily capacity of this plant is 176 tons of frozen peas a day. In actual loaded conditions, the evaporator temperatures delivered by this unit have been between −34 deg. F. and −42 deg. F. It provides freezing temperatures for four column type and two continuous package type food freezers. The system operates under 11 in. of vacuum and uses 1,100 lb. of Freon 12 as its refrigerant. These package units are also use for refrigerating other foods, such as meats (chilling) and fish (freezing).

Automatic Controls

Automatic refrigeration controls found acceptance about 25 years ago. First to be used was the automatic expansion valve. This is essentially a down-stream regulator. While this instrument did eliminate the need for manual adjustment of valves for every change in refrigeration load in a system, it had certain disadvantages. It did not positively eliminate flood-back of refrigerant and did not lend itself to multiple compressor hook-ups.

So, engineers went a step further and developed the thermostatic expansion valve. This automatic valve is actuated by the superheat of suction gas leaving the evaporator. It is like an automatic expansion valve in design but has, in addition, a power element that is responsive to changes of the temperature of superheat of

- **Reflection Cuts Heat Loss 70%**
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the refrigerant gas leaving the evaporator. It maintains a constant and uniform flow of liquid refrigerant to the evaporator, keeping the coil completely filled with evaporating refrigerant. It also maintains a constant superheat in the vapor leaving the coil.

Following closely on this development came the magnetic, or liquid line shut-off valves, equipped with float switches. Generally used as master shut-off valves, these units are installed in the systems ahead of the thermostatic expansion valves and become additional controls for the liquid level in the evaporators.

With development of the evaporator pressure regulator, which is used on the suction side of the evaporator and controls up-stream pressure, refrigeration systems were fairly well robotized in 1936.

Now, from a central control panel, the refrigeration system is controlled by one operator, and electronic instruments automatically protect it from damage by shutting off its operation.

New Refrigerants

Early in this quarter-century, Freon 12 made its appearance, and at a later date the Carrenes. These newer refrigerants were developed for special applications. They are non-explosive, non-toxic, non-flammable, and non-corrosive to metals used in refrigeration systems. Although ammonia still remains the most efficient and economical refrigerant, it does not incorporate the safety features of the Freons. Freon 12 and Freon 22 are used with reciprocating compressors, the latter refrigerant being used in low-temperature systems. Freon 11 finds its greatest use in the large centrifugal type of units.

Evaporative Condensers

Bringing economy in first cost, also in installation and in maintenance, evaporative condensers are used to supplant shell and tube type condensers and their cooling towers. These small, package units require less space, are much lighter in weight, and need no long pipe lines and additional pumps, such as employed on older style condensers. They effect savings of up to 95% of water normally required by cooling-tower, shell and tube condensers.

The finned tube, used in conjunction with refrigeration evaporators and evaporator condensers, has also progressed through a series of advances. Developed in 1882, the fins, added to the prime surface of tubes, increase the outside surface area. Design refinements in this type of piping followed, and in 1936, the integral finned tube was developed. This is an extruded, cupro-nickel tube with fins formed from the wall of the pipe. These fin tubes have a prime surface ratio of 3 to 10 times that of plain pipe and thus permit the reduction in unit size in addition to giving additional evaporation surface.

terials up to 1928. Since then many new materials have been developed. Some of these have a high, constant k factor, and are impervious to moisture and moisture-vapor, rodent proof, incombustible, and high in tensile strength. These factors contribute economy in construction, operation, sanitation, and safety in food plants.

Reflective insulation retards conductance by reducing radiant heat transfer. It reduces radiation in walls from 1.1 Btu. an hr. per sq. ft. per degree of temperature difference to about 0.3 to 0.32 Btu.

Cold Diffusers

Used initially by meat and dairy firms, cold diffusers are now found in many kinds of food and beverage plants. They provide cooling, hardening, and quick-freezing temperatures. And the later units eliminate the troublesome frost problem.

The newer cold diffusers have supplanted the older wall or ceiling coil-banks. They dispense with the manual attention needed by the old-style coil systems, and the evaporator of one of these ammonia package-type units is more compact per ton compared with any other.

Quick-Freezing Units

Contributing significantly to recent advances in refrigeration engineering are quick freezing and low temperature storage and distribution. The need for low-temperatures (from 0 to −40 deg. F.) demanded installations of many 2-stage systems.

Quick freezing was just beginning in 1928. Today, production volume of fruits is 420 million lb.; vegetables 896 million lb., and of the more recent concentrated frozen citrus juices 48 million gal. (1952 figures).

As production volume increased, the demand for more refrigeration equipment and materials for storage and distribution has likewise grown. At about the mid-point of this period, there was 50 million cu. ft. of freezer space in public warehouses. Presently, there is more than 145 million cu. ft.

Practically every advance in refrigeration engineering developed during the past 25 years has been adapted to food freezing or food freezing systems. Currently there are about 21 types of quick-freezing systems in use. These range all the way from the original, but now refined, airblast and coil types to the newer continuous package freezer units and column type freezers.

The size of some of today's freezing plants compared to those of an earlier year can be measured by production volume. In 1935 the total frozen vegetable production reported for the Western States was some 7 million lb. Today, the production of a single, relatively modern freezing plant, producing only frozen peas, will be nearly double that figure.

Heat Balance Improved

Both alcoholic and non-alcoholic beverages utilize refrigeration in their processes. And thermal engineering has developed a number of economies in brewery energy balance. To improve the heat balance, engineers in larger breweries are again beginning to install steam turbines as drives for the new lightweight, multi-cylinder type compressors. Steam, intended for heating purposes in the brewing process, is first cycled through these turbines, then used for heating.

Multiple units of the newer type cold diffusers are used to maintain desirable temperatures in stock houses. Large centrifugal ammonia compressors were adapted to brewing refrigeration systems directly following Repeal.

cooled to 0 or −5 deg. F. and, in some breweries, only one of these units is required for all refrigeration needs.

Continuous Heat Exchanger

Important advances in processing refrigeration (as well as heating) have been made with the continuous, rotary, scraper-type heat exchanger. Rates of heat transfer of this apparatus are from six to ten times higher than those of any other known heat-exchange mechanism, when processing viscous materials. The efficiency of this compact unit lies in its enclosed heat transfer mechanism.

Advances Set Trends

A summary of the major advances occurring during the past 25 years will provide a good springboard for a prognostication:

The demand for lower and lower temperatures has necessitated the installation of higher speed compressors, boosters, and more insulation. The large scale transition from cooler to freezer operations and the growing volume of frozen items necessitated construction of considerable new refrigerated public warehouse operations.

Food freezer sales plans, some of which were successful, have added additional millions of cu. ft. of frozen food storage space in home freezer cabinets. Such investments by individuals demonstrate that frozen foods have reached a permanent consumer acceptance.

Because frozen foods must be kept frozen, all distribution factors have, one by one, provided low temperatures for these products. Today, the low temperature cycle is complete. Frozen foods, held by packers at 0 deg. F., may move through transport and storage several times before reaching consumers, and never be exposed overlong to temperatures above 0.

Truck transport first offered these more desirable temperatures. Trucks now are adequately insulated, and refrigeration is provided by truck compressors or by coldplates which store refrigeration supplied by compressors at the plant. Even retail milk trucks now are mechanically refrigerated. Recently, after several years of experimentation, railroads have begun the contribution of a fleet of mechanically refrigerated reefers aimed to provide uniformly low temperatures.

Automatic operation of systems and automatic defrosting now eliminate manual attention. Today, fin-tubing gives as much refrigeration value in 2 ft. as did 12 ft. of the old type pipe.

Cooling by vacuum evaporation currently is finding application in a number of food processes. Within the range of its effectiveness–end-points above freezing–"vac evap" cooling now is used to lower temperatures of raw materials, products during processing, finished products, and water for recycling. End-point temperatures from 79 deg. F. (29.00 in. Hg) to 34.6 deg. F. (29.80 in. Hg) may be attained. This technique is limited to applications where weight loss due to evaporation is permissible.

Events Point to Future

All of these trends, leading up to the present, point toward a future in which refrigeration systems will be completely automated and hence will need no manual attention to operate.

Compressors have already been run, experimentally, up to 5,000 rpm. These light "little giant," multiple cylinder compressors of today may again be redesigned, like the new high-compression automobile engines of this year, so they will produce more tons of refrigeration per unit. New refrigerants may facilitate the design and operation of these new compressors. All new plants will be equipped with the new types of pipe that are easy to defrost. These plants will be designed with an oversupply of refrigeration equipment and pipe work. And they will have provisions for further expansion at later dates.

In the past, food engineers have often pointed out that the ultimate fruit, berry, or vegetable juice would be a powder. But these powders are highly hygroscopic and it is conceivable that, eventually, refrigeration with extremely low humidity may play a part in the storage of these products as well as in their low-temperature evaporation process.

Dehydrofreezing–the process of dehydrating, then freezing, foods–may be one of these. It now has only limited application. For some food products, the dehydrofreeze plant of tomorrow may well be one that is comprised of vacuum dehydration, then freezing.

Here the refrigeration system will provide both heat for dehydration, and cold for the barometric condenser water as well as the freezing operation.

Recent research reveals that pre-freezing speeds dehydration of vegetables, opening a new field for refrigeration. And research has demonstrated that nuts, dried fruits, canned foods, candy, and myriad other products will, when stored under proper refrigeration, retain their condition of quality to a much higher degree.

Freeze-drying (drying in frozen state by sublimation) may eventually become the accepted process for expensive foods such as shrimp. And concentration by freezing may find future favor because it does not damage the flavor or vitamin content of heat-sensitive foods.

A resurgence of interest in absorption type refrigerating machines has occurred with recent development of units that employ water as a refrigerant. Since these use low pressure steam to chill water by the absorption principle, they should fit nicely into a plant's heat balance.

Great interest has also developed in the heat-pump for low-temperature evaporators and as a means of reclaiming Btu.'s removed in cooling process areas. A bakery in Texas is currently cooling 6,000 loaves of bread an hour with the refrigeration side of a 50-ton heat pump. Condensation from cooling on the bottom of the loaves is then driven off by heat furnished from the high side of the same compressor.

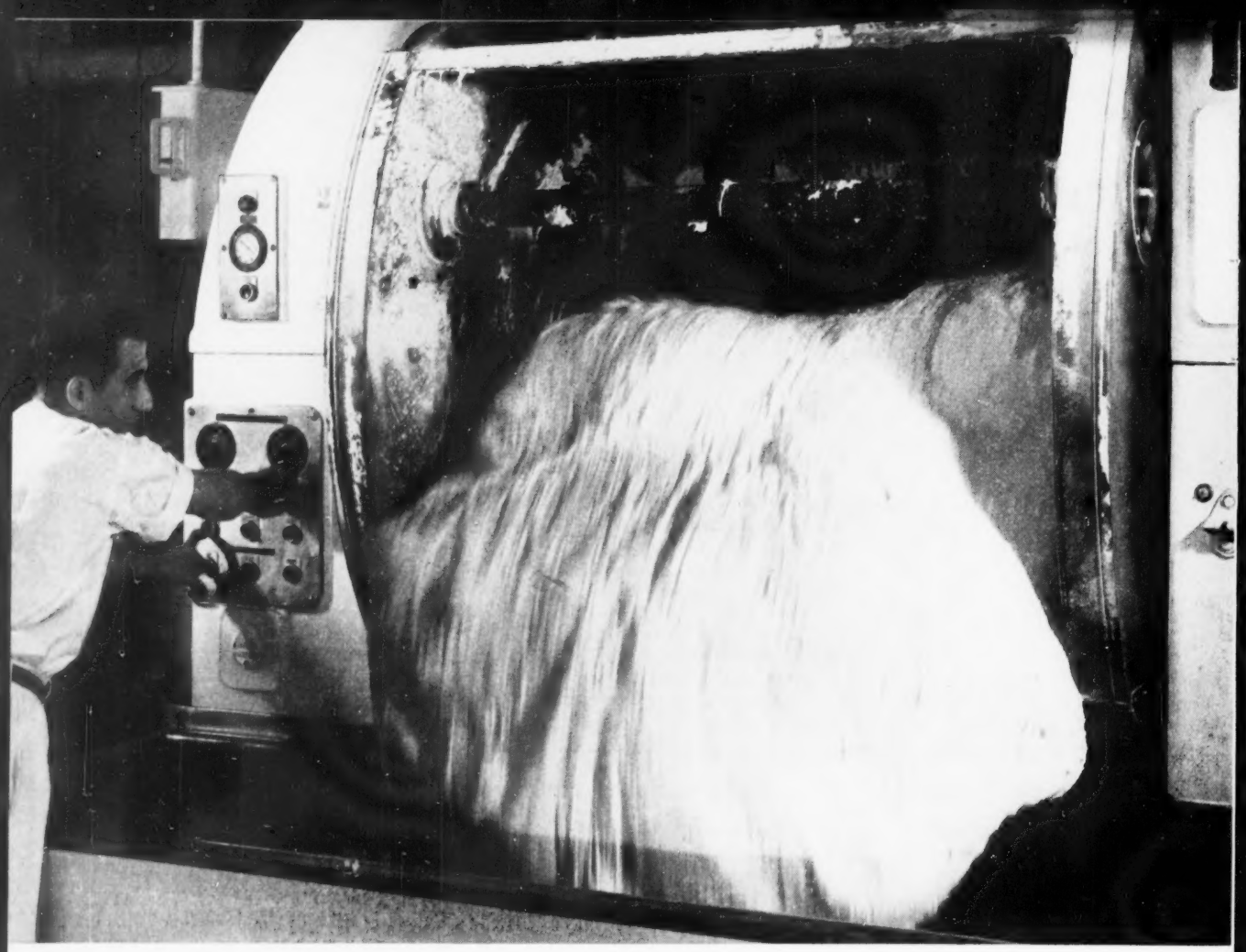
Some years ago, Charles F. Kettering predicted that the progress of civilization, having previously depended on the use of heat, would in the future be measured by the intelligent application of cold.

In foods, today's problems are how to protect them in processing and how to keep them in storage. And trends in the food industry point towards wider utilization of low temperatures in receiving, processing, storage, and distribution.

Yes, by 1978, refrigeration will play a much bigger role in the food industry, important though it is today.

It may even team up with surface sterilization by ionizing radiation to change the processing and distribution patterns for many highly perishable foods.

See Much Greater Role for Refrigeration by '78



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AIR CONDITIONING

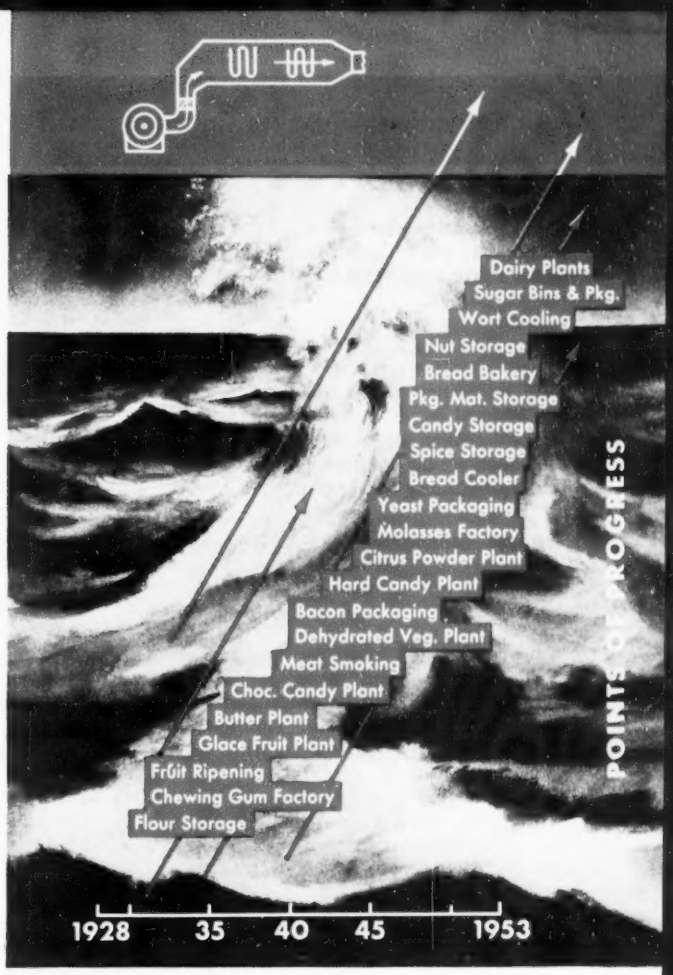
FOOD COMPANIES pioneered in the use of "engineered" atmospheres. And five economically compelling needs underline their interest:

1. Retention of quality and workability of raw materials.
2. Maintenance of optimum conditions for carrying out a process.
3. Reduction of product weight losses in process.
4. Prevention of spoilage in finished goods.
5. Protection against contamination of material or product by airborne micro-organisms.

Further emphasizing these basic needs is today's accent on volume production. New continuous processes, speedier packaging, efficient materials handling all put a premium on proper atmosphere.

Food manufacturers must not only deal with temperatures, humidities, and air velocities far beyond the personal comfort zone, but must consider techniques of bactericidal and gaseous control of atmospheres that would actually be non-supporting to human life.

For example, basic psychrometric approaches have to be combined with biological balances when considering such techniques as use of carbon dioxide and ethylene in fruit storage and ripening.



Points of progress are air conditioning applications.

Well Established

In October, 1928, the first issue of FOOD INDUSTRIES described a $17,000 air conditioning installation in a Knoxville, Tenn., flour mill. Serving the elevator legs, purifier floor, and roll line, it paid for itself in less than a year.

Other early users of controlled air conditioning systems were bakers, candymakers, meat packers, brewers, and dairies. And most of these processors had atmosphere problems that required the flexible use of mechanical refrigeration.

In the early '30's, meat packers—particularly the smaller ones who had not been able to afford extensive central air-conditioning—were experimenting with pre-fabricated unit cooler systems.

Essentially the unit cooler, introduced around '28, was a very compact dry coil brine spray apparatus with a built-in fan to move used air up and through the cooling spray and out into the process area.

A small San Mateo, Calif., packer replaced direct-expansion ammonia wall coils in a chill room with such a unit. And estimated savings in this plant were 2½% reduction in meat shrink and 20% less power costs with a doubled throughput.

By Depression time, the concept of unit conditioning and its advantages was fast coming on throughout the food field.

A Providence brewery in the early '30's converted to unit brine-spray coolers for conditioning eight fermenting and storage cellars. Purpose was to keep cellars dry and prevent growth of micro-organisms.

An installation in a banana ripening room of the time reduced weight losses due to shrink from 10% to less than 1%—a saving of over 200 lb. of product per ton. A cereal manufacturer was able to increase his packaging production by over 10%. Spot air conditioning prevented huge condensation losses in a 12,000,000 lb. sugar warehouse.

Improvements

Not only had better and cheaper refrigeration been developed, but other elements of basic air control had reached an advanced state of development prior to 1940.

New methods of humidifying and air distributing were being uncovered. Better methods for cleaning the air appeared. Before the '30's, oil coated filters were developed. Glass fibers for panel-type filters came soon after.

In '34, ultraviolet irradiation of air to reduce bacteria and mold population was utilized. And a year later there was witnessed the first electrostatic precipitator in a conditioning system.

Other ways of attacking odors and molds appeared at time. By the mid '30's, ozone generators were being used in storage plants to combat decay and remove the contaminating smell of such items as onions, bananas, and sugar.

In 1936 a basic patent was filed for an odor removing apparatus employing activated carbon. One such device used activated coconut shell carbon enclosed in canisters placed directly in-stream in the storage air cooling system.

Techniques for air composition control were also being

probed in the '30's. Ethylene at fixed concentration under exact conditions of temperature, humidity, and movement, was already being used to hasten ripening of citrus fruits and bananas as well as loosen the hulls of mature walnuts.

Also, around this period, an improved method of ridding air of suspended dust consisted of ceiling-suspended woven-fabric filtering tubes. Efficiency was claimed to be 99% for particles 10 microns or larger.

Chemical or adsorption type dehumidifiers were appearing to challenge normal spray-type dewpoint control. One such set-up employing lithium chloride was used in the low-humidity drying of egg albumin.

Process Innovations

Advances in air conditioning in the '30's often led to a complete upheaval in long accepted ways of food processing.

Air-conditioned smoking appeared in a Halifax fish plant in 1928. This involved a fan heater aligned by duct with the smoke chamber, and closed circulation in a one-story, insulated room. Humidity was controlled by automatically proportioning outside air into the system.

Development of unit conditioning equipment next permitted a complete smoke and air make-up assembly outside the airtight smoking chamber. Proper distribution of heat and smoke provided as much as 50% fuel savings. But the greatest benefit came in faster, more uniform production—together with substantial shrink reduction.

In the mid-'30's, a Chicago bakery replaced its aged cabinet fermenters with a compact automatically controlled air conditioned room served by two sweet-water cooled steam-spray humidifier units. Temperature was held at 78 deg. F. and r.h. at 75% in this 75 by 30 ft. room.

Elimination of fermenter drafts and precise instrument control of humidity minimized a former crusting problem and reduced moisture losses by over 1.0%. The installation paid for itself in two years.

Air conditioned bread cooling in 1932 sped production. A tunnel conveyor moved the hot bread through high-velocity countercurrent conditioned air, cutting cooling time from several hours to 75 min.

Progress to Date

In the past ten years, atmosphere control—sparked by some vital new equipment developments—has assumed even broader significance in food processing.

Concentrations of 15 to 20% have been responsible for doubling the storage life of fresh raspberries and strawberries. Similar atmospheres are being used to "blanket" cherries in refrigerated shipment from the West Coast. It also developed that controlled atmospheres of excess CO_2 would double the storage life of McIntosh apples.

Currently, benefits of straight air conditioned storage are being probed for peanuts, pecans, and other nutmeats. Sustained temperatures of around 32 deg. F. with r.h. at 68% provide top year-round keeping quality and check insect damage. Activated carbon is found very helpful in adsorbing odors which nuts normally pick up in storage.

Another significant development has been use of almost total inert gas blanketing for bulk stored foods. Here, the object may be to remove oxygen deterioration, stifle infestations, or simply eliminate dust and explosion hazards.

General Mills, in using the principle for the first time on bin stored grain in its Los Angeles plant, believes that benefits of this controlled storage atmosphere are actually a combination of these reasons.

Use of nitrogen blanketing over milk—as is done in the "Med-O-Milk" aseptic canning process—is, however, primarily to prevent oxidative deterioration. The same holds true in recent commercial use of the technique in processing and storing edible oils.

A recent development in meat packing—hog immobilization—uses a controlled carbon dioxide atmosphere.

The need for very low humidity, controlled air in handling hygroscopic materials sponsored a widespread appearance of many self-contained air conditioning units in packaging areas. However, atmospheres for handling a hygroscopic product often ran as low as 20% r.h. Naturally, ductless spray-type conditioners could not be used, due to moisture in the air freezing and jamming up of equipment.

Critical Humidity

The solution has proved to be use of chemical absorbents, such as ethylene glycol or lithium chloride, teamed with refrigeration. As the absorbent dilutes it is continuously regenerated by passage over low pressure steam coils.

One such system has been serving critical pan-coating operations at the Wrigley gum company since 1947. Here, it was found that dry air at about 29 r.h. and 90 deg. F. produced optimum results in pan coating "PK." gum.

Similar units have been installed in breakfast food packaging rooms, where moisture removal often mounts up to a ton per day.

Brittleness, shrinkage, and expansion of packaging materials due to improper storage and packaging room atmosphere can often lead to delays and bottlenecks in production. Also, spoiled product at later date. So several rather inexpensive but precise-acting humidifiers have appeared recently to serve these storage rooms. One such unit powered by a $\frac{1}{8}$-hp. motor discharges moisture by centrifugal atomization at a rate of 3 pints per hr. A remote humidistat controls its operation.

Purer Air

Some highly interesting developments in air purity control have cascaded into industry in the past few years. In addition to built-in panel filters, many food plants have gone to separate integral control systems to rid processing areas of dust. And cloth filter units, with an efficiency of over 98% for micron size particles, are widely employed in these installations.

In 1948 a basic advance was offered by the new H. J. Hersey cloth filter. It employs moving rings passing up a cloth tube and jetting countercurrent high pressure air to dislodge particles.

Widespread installations of complete dust control systems based on this new filter have been made since '48. One recent set-up in the new 3,500,000 bu. Schlitz barley elevator provides almost complete dust-free operations, yet only one pound of forced air is needed for every pound of grain handled.

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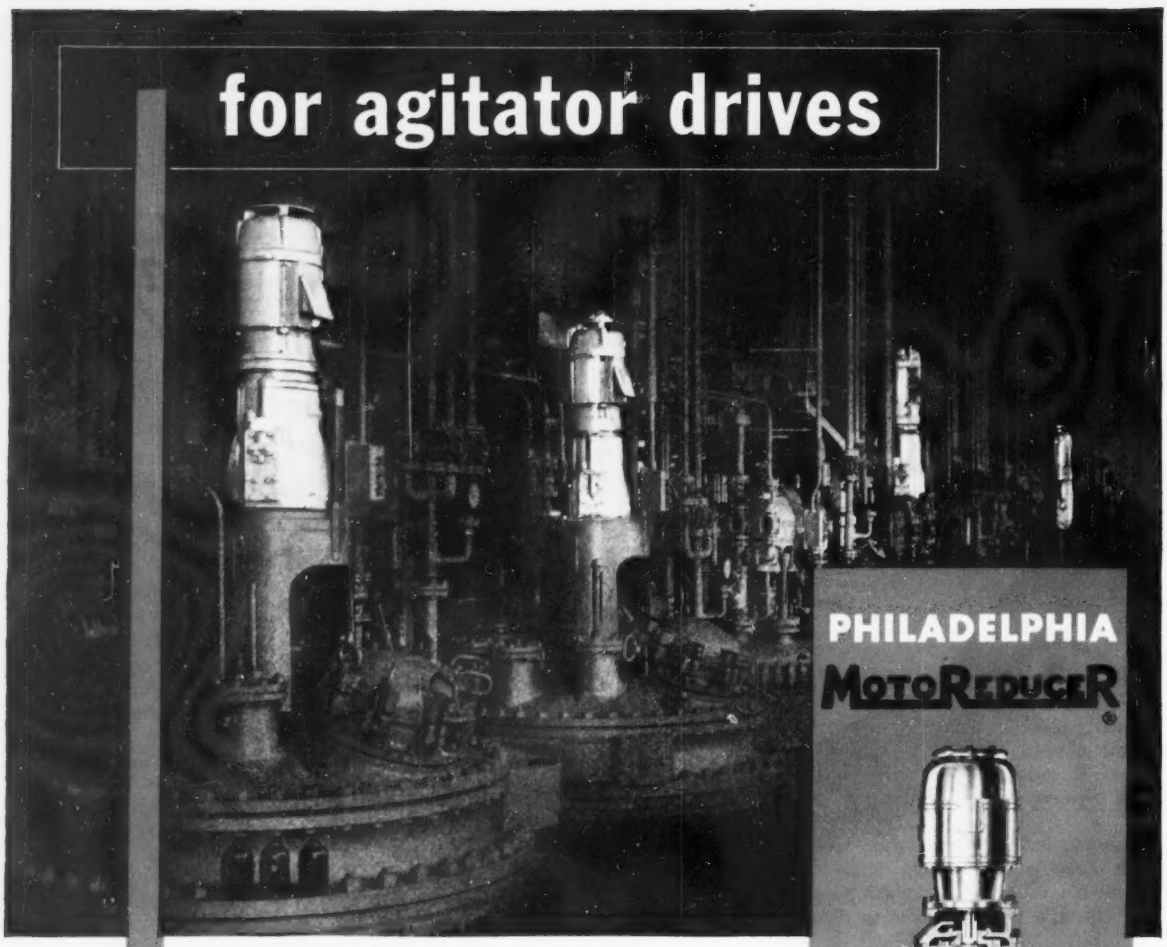

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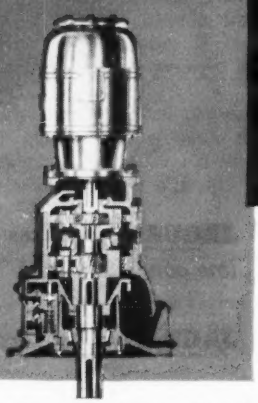

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Here, in a new eastern chemical plant, are shown excellent examples of the advantages offered by Philadelphia vertical MotoReduceRs for agitator drive application. More than a hundred of these units are now installed here.

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Electronic means have also been perfected to remove fine dust particles and sterilize air for critical processes. Pfeiffer Brewing in Detroit, for example, cleans all air to its wort cooling room by passing it through an electrostatic precipitator that separates dust particles as small as 1/250,000 in. dia. Following this treatment, the filtered air passes between a bank of bacteriacidal ultraviolet lamps in order to inactivate any organisms that still might be present.

Various ways of deodorizing air in conditioning systems have been developed. A canister insert of activated coconut shell carbon has shown considerable promise in fruit and vegetable storage.

Ozone as a means of killing odors and controlling mold growth has also come into its own. A small generator plugs into a conventional wall outlet and will supply a sizable room area. In 1951, Gettlemen Brewery in Milwaukee reported that use of ozonators in the fermenting cellars had killed all mold on walls, ceilings, and tanks and cured the area of foreign odors.

Further Strides

Recently a cheese plant has experimented with yet another way of dealing with airborne microflora. This is essentially a portable glycol vaporizer able to treat up to 100,000 cu. ft. per hour. Incidentally, the sterilizing ability of glycol has also been noted when used as a dehumidifying spray in air conditioning units.

Two chemical attempts to get rid of noxious process odors have recently been tried. An outside air scrubber employing chlorine dioxide sprays has proven effective in purifying of smells from animal-fat and fish rendering.

A new combustion catalyst is being used to deodorize exhaust from a Long Island coffee plant. This is a small assembly of porcelain rods coated with a film of catalytic alumina and platinum. It is inserted in each exhaust stack and combustion of gases and noxious fumes takes place at the surface of the rods.

Efficiency Gains

Flexibility of centrifugal systems—ability to drive the compressor with a variety of electric motors as well as a steam turbine—has fostered a trend back to large central installations and secondary refrigerant circulation for spot conditioning jobs. Ammonia is proving an excellent secondary refrigerant in such systems due to its oil-free, flash-free cycle at low pressure, and its non-corrosiveness.

Adsorbent type dehumidifiers now produce needed low humidities for high-velocity air cooling jobs. A large candy bar manufacturer, for example, solved the problem of congealing nougat on a continuously moving belt—a previous rack cooling job taking hours—with such an installation.

Conservation of water is of growing concern. To condense refrigerant, about 2 gal. of water is needed per minute for each ton of refrigeration. Hence, 100 tons involves over 2 million gal. of water per month. Cooling towers for recirculating this water save as much as 98% of it.

Evaporative condensers also save as much as 95% water and 15% power costs. Further, less pumping head is required then when serving a cooling tower.

Air Conditioning in '78

Where are today's developments leading? And how extensively will controlled atmospheres be employed in the average food plant of the future?

Tomorrow's food plant will be completely air-conditioned for worker comfort, better processing, maximum packaging, and optimum protection of raw materials and finished products.

To assure high purity, recirculated and incoming air will pass through electronic dust filters and chemical, microflora and odor removers, or over germicidal lamps. Further, raised area pressures will assure no drift inward of contaminating atmospheres.

Inert gas blankets and gas-proportioned atmospheres will protect bulk stored liquids and solids.

With packaging speeds skyrocketing, more precision in air conditioning as well as materials storage will be needed.

Movement of finished goods, if perishable, will take place from controlled storage areas, through sterile, air-conditioned shipping platforms, onto atmospherically controlled transport.

What About Equipment?

Prototypes of all tomorrow's air conditioning equipment are pretty much here today. Hence the big question has more to do with use than evolution.

A major factor in selecting and developing atmospheric control systems in the plant will be their place in the overall heat balance of the operation. In plants where huge amounts of cooling as well as heating is needed, large central steam-turbine driven centrifugal installations will provide refrigeration at very little cost.

Use of heat-pumps will be spurred by greater need to conserve heat and by increasing costs for fuel and water in food processing.

How To Meet It?

What can an alert food processor do today to meet tomorrow's atmospheric challenge?

He must first adopt the hypothetical attitude of that future food plant manager—that need for conditioned air is as vital, as routine, as understandable as the need for simple space heating is today.

So oriented, it becomes a simple matter to conceive of atmospheric control as an integral part of the plant's heat balance. The next step for a food plant manager is to consider new and profitable ways to apply it in his operations.

He should consider such factors as storage losses, production problems, and packaging efficiency—in fact just about any operation in his plant where product, time, or manpower is lost.

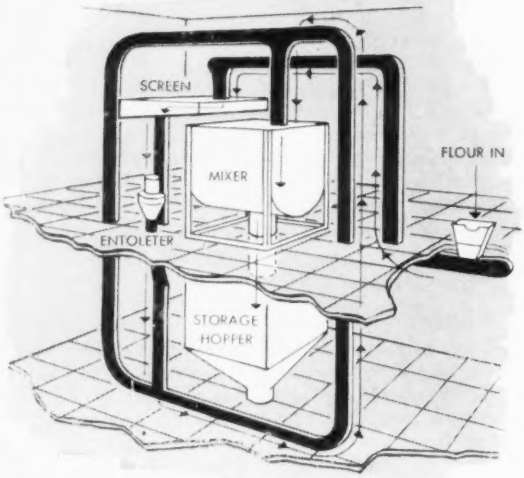
At this point, progressive development of systems to eliminate the above losses, may call for outside experts. Practically all in-plant atmospheric control jobs have to be tailor-made to suit specific requirements.

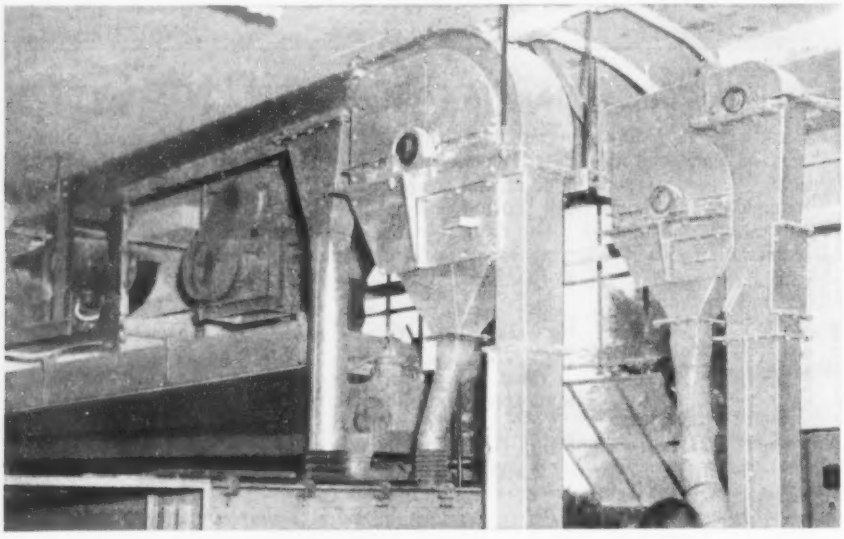
Why S-A CONVEYING Systems

Earn **Repeat Orders** for Food Handling

Twice, S-A Redler conveyors have been the first choice for handling cake mix at this plant. The first Redler installation demonstrated the cleanliness, the dustless delivery of extremely fine material, and the compact installation as well as the operating economies these totally enclosed conveyors make possible. A second Redler system was the logical choice when the blending process was expanded.

Where dust-free, contamination-free movement of food materials at lowest cost is important, consult S-A. You get the services of an engineering staff backed by more than fifty years' experience in the materials handling field *plus* a complete selection of conveying equipment. This combination of men and equipment assures you of the best conveying system at the least cost. Write for a free survey.





At Jewel Tea Co.,

Barrington, Illinois, totally enclosed S-A Redler Conveyors lift flour from storage to a screen at ceiling height. There it is sifted and falls into an entoleter. The flour then falls one floor level to a newly installed Redler "run-around" conveyor which again elevates it and discharges into a mixer. Flour then falls into a storage hopper. Use of compact Redlers permitted screen to be placed over mixer without conveyor interference. Neoprene gaskets seal all casing joints, keeping flour in and dirt out.

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WASTE DISPOSAL

INTENSIFIED DEMANDS that pollution of surface waters be reduced and controlled are coming from all sides. As a result, food plants have made great strides in reducing wastes going into sewers. Good housekeeping practices, recovery of by products, and re-use of waters all have played a part.

Yet unique processes for treating food wastes have been developed in only a few instances.

The National Resources Committee report of 1939 disclosed food and beverage wastes as constituting the greatest industrial wastes.

Estimates were made in 1947 on yearly water consumption. In terms of millions of gallons, they showed 41,373 used by 440 breweries . . . 8,520 by 2,265 canneries . . . 6,250 by 5,618 bottlers of soft drinks . . . and 568 by 2,153 meat packers.

This total of 10,476 establishments consumed 70,997 millions of gallons of water yearly. Included in the latter figure are 14,286 millions of gallons representing dairies. Yearly water consumption in the remaining branches of the food industry was 71 billion gallons. Not all, of course, was discharged as waste.

Drainage Basin Reports, published by the Public Health Service (1951) summarized the numbers of food and allied industry establishments as compared with available treatments with separate outlets to watercourses. This indicates and discharged directly into watercourses were included.

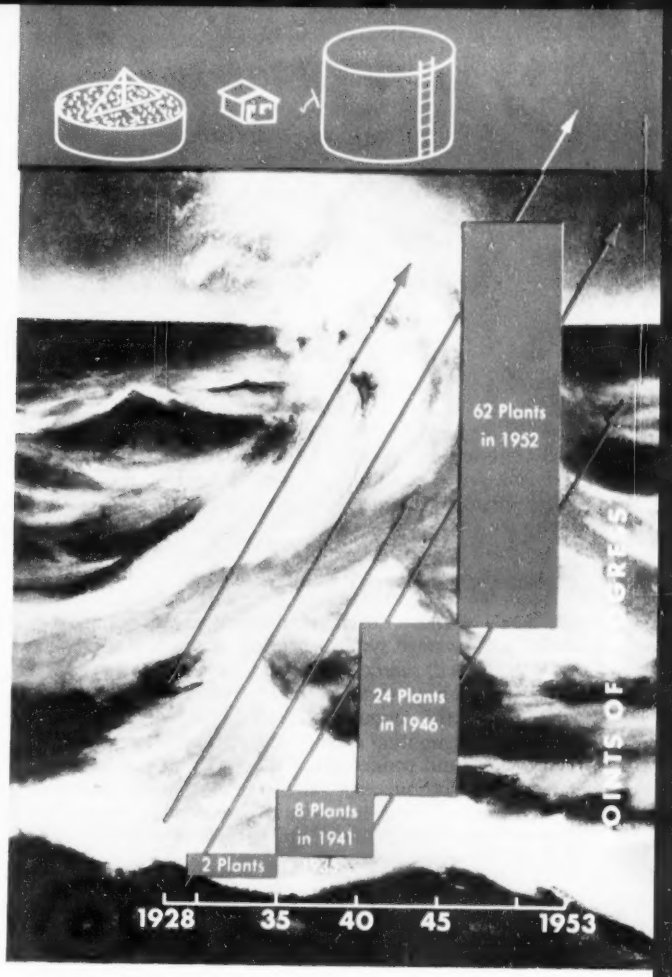
According to the reports, there were 3,847 food establishments in the various drainage basins. The difference between this estimate and the previously mentioned 10,476 could be taken as a rough measure of the number of food wastes discharged into municipal sewers.

There were 1,123 food establishments with known treatment facilities, which constituted 29% of the total. The balance is assumed discharged into watercourses without treatment, since this survey included only those establishments with separate outlets to watercourses. This indicates the work still remaining in pollution abatement.

A survey by the Interstate Sanitation Commission for 1951 revealed that 148 food plants were discharging 18.9 million gallons of waste daily into waters under its jurisdiction in New York, New Jersey, and Connecticut. Of these plants, only 35, or 24%, treated wastes at the source.

A national census, published by *Wastes Engineering* covered industrial waste-treatment plants built in 1952. It reveals 3 for breweries, 38 for dairies, 41 for canneries, 17 for meat-processing plants, and 4 for beet sugar refineries. It also indicates that greatest activity in the construction of such facilities was in Pennsylvania, Wisconsin, Minnesota, and Michigan, and that most treatment plants were designed for dairy and cannery wastes.

Of the various food establishments, dairies, canneries, and meat packing plants have, by far, the greatest number of waste-treatment facilities.



Points of progress are rises in treatment units in typical food-plant states—Pennsylvania and Oregon.

And the most common treatment methods involve (in the descending order): Lagoons, septic tanks or cesspools, screens, sedimentation, land irrigation, sand filtration, chemical treatment, and spray irrigation. Comparatively few use trickling filters and activated sludge.

Trends and Developments

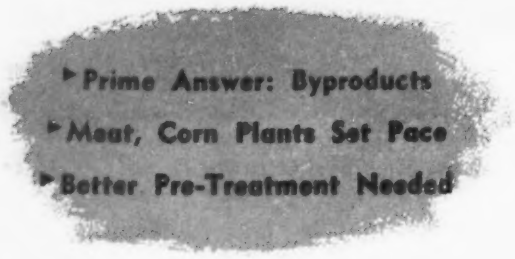
As a result of the attention to recovery of byproducts from wastes, pollution has been reduced at minimum expense and, at times, to some profit. Resulting byproducts, have been utilized in some foodstuffs and feeds.

Developments in byproduct recovery have been more outstanding in the dairying, meat packing, brewing, and corn products refining fields, than in canning. Additional possibilities are foreseen in this direction.

Even if waste prevention and recovery do not result in a profit, there should thus be a favorable balancing of cost of treatment with the most intangible beneficial effect on public relations, which is getting more attention.

Discharge of waste into municipal sewage and treatment systems offers, in many cases, the best solution of the pollution-abatement problem. And it is the most common method.

But the wastes that are produced during heavy seasonal operations present a problem—one involving balancing the cost of increasing capacities for short-time treatment against the cost of installing separate treatment with direct



discharge into a stream or of pretreating with subsequent disposal into a sewer.

By preventing product losses, recovering byproducts, and giving wastes additional pretreatment at the source, it is often possible to overcome certain plant-operating problems.

Problem of Seasonal Loads

There's a move to divert cannery wastes away from municipal sewerage systems because of seasonal overloads. In Washington, municipalities have assumed the responsibility for treating wastes removed from sewerage systems.

Reducing the amount of water used in various processes and segregating cleaner waters from cooling towers, evaporators, and condensers is the first step toward abatement of pollution, especially when separate treatment is necessary. This system would considerably reduce the size and cost of treatment units, even though the same amount of wastes were handled.

Segregated cleaner waters could be directly discharged into a stream or into the effluent from the treatment plant. The segregated waters could also be recirculated in cooling towers and re-used in other ways, thereby conserving water.

Preventing unnecessary losses of raw materials—with or without recovery of byproducts—is the next step. A 1% loss of materials may seem small to an industrial engineer but, in many instances, it constitutes a waste several times more concentrated than domestic sewage and one necessitating costly treatment.

There are many examples in the food industry where prevention and recovery have paid for the equipment and operation within a few years.

In calculating profit from the recovery of a product from food waste, it is not sufficient to balance the cost of recovery against that of production. The alternative cost of waste disposal and treatment should be considered. If the value of the product plus cost of disposal is greater than the cost to process the waste, then the excess should be considered a profit.

Byproducts From Dairy Wastes

Prevention of milk waste from drips, leaks, and first rinses could result in treatment savings. Emphasis in larger milk plants has been on separating whey, skimmed milk, and buttermilk from general wastes, together with recovery of valuable byproducts and reduction of pollution. Byproducts from whey include whey powder, sweet and sour whey concentrates, lactic acid, milk sugar, lactalbumin, alcohol, and vinegar. Whey is evaporated into a syrup, which is dried in spray or roll type units.

Almost all whey powder is now used for poultry feed. Some is added to foods for human consumption. Sweet whey concentrate goes into animal food or foods for human consumption, while sour whey concentrate is extensively employed for animal feed.

Manufacture of whey concentrates entails a smaller investment for equipment than is required for the production of dry powder. However, several milk plants ship their concentrates to a centrally located drying plant.

Comparatively small amounts of whey are used to make lactic acid, milk sugar, and lactalbumin. Processes employed for these products leave a liquid residue which, in turn, can be dried and used as animal feed.

Smaller amounts of fluid whey go for feeding hogs. Buttermilk is also processed into concentrates or powder, which are used in human and animal foods. Small amounts of fluid buttermilk are for human consumption.

Despite the growing recovery of byproducts from whey and buttermilk, large amounts of these materials are still wasted. Treatment of skim milk with hydrochloric acid and subsequent recovery of milk sugar is feasible, but the market is limited for this product as well as for lactic acid and calcium lactate.

Too Much Water Used in Canneries

The volume of water used in canneries for washing cans and vegetables as well as for heat processing can be reduced. Materials from liquid cannery wastes are not being recovered at present. Only exception is use of water from a few canneries for land irrigation. Solid wastes could furnish a large quantity of usable products. But their actual utilization is not extensively practiced because of the seasonal nature of operations, perishable nature of the waste, and low financial return.

Examples of utilization of solid wastes are curing and selling pea vines for cattle feed and using corn cobs and husks as a feed.

Not utilized are wastes from such vegetables as lima beans, green beans, and spinach. Some canners, however, dry tomato wastes. Feasible is the use of asparagus butts for feeds, fertilizer, and fiberboard.

Centrally located waste recovery plants serving several canners would prove helpful.

Byproduct recovery from solid fruit-processing wastes is somewhat more prevalent. Apple peels, cores, and culls are used to make vinegar, pectin, or cattle feed. Stone fruits, such as apricots, peaches, and cherries, yield pits (for oil) and fruit flesh. Shells may be ground for wood plastic and absorbent charcoal.

Long List of Citrus Byproducts

Great strides have been made in the recovery of products from solid wastes produced in canning citrus fruits. Since 1927, the solid wastes utilized consist of peels, rags, and seed. In 1949 nearly 90% of the solid waste was dried for feed purposes in Florida. In addition, peel oils, seed oil, pectin, brined and candied peels are being made.

But recovery of these byproducts from the solid wastes results in liquid wastes of pollutional character. Initial attempts were made to recover, from the press liquor, yeast, lactic acid, methane, and alcohol, but the amount of these materials available exceeded their demand.

Since 1949, press juice from pulp has been successfully evaporated to molasses for cattle feed. The molasses has also been added to the press-cake solids prior to drying. By recycling partially dried solids, the quantity of molasses in the feed has been increased to 75%.

Recovery of byproducts from packinghouse wastes is an integral part of the economy in this branch of the industry. However, it requires proper equipment and operation to minimize the losses. And no matter how efficient the recovery, the wastes discharged are still more concentrated than domestic sewage.

It is essential to salvage grease by means of screens, evacuators, skimming basins, or traps.

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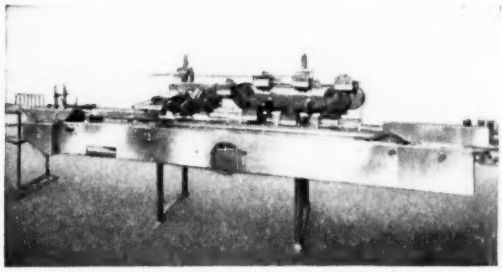

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Spray and Digestion Systems—Are Key Factors

Yard manure is recovered for fertilizer. Blood should be recovered as a fertilizer, except for unavoidable losses. Many more byproducts, such as cortisone, insulin, and animal protein factors, have now been added to the list.

In beet-sugar refining, battery-wash water, pulp-press water, and lime-cake drainage can be eliminated. Flume water may be treated by settling and re-used. Since the soluble solids accumulated after continuous recycling give rise to objectionable odors, it is generally advisable to bleed a portion and make up with fresh water. Battery-wash water is often used to wash beets.

A number of byproducts result. Pulp, after extracting the sugar, is pressed, dried, and used for animal feed. Steffens waste can be utilized for coagulating flume and process water. This waste has been returned to the soil, concentrated and sold as fertilizer, or concentrated and calcined for the recovery of potash.

Corn-Product Practices Notable

The manufacture of corn products is a good example of pollution abatement through greater recovery of wastes without resorting to treatment methods. It has been accomplished by isolating waste-bearing waters, re-using process waters, and recovering more and more solids. At first, only the starch, which constituted 50% of the weight of corn, was utilized; while other constituents such as bran, gluten, and germ were discarded. Now recovery of these byproducts makes the existence of this branch of the industry possible.

A reduction of 92% in population equivalent (per capita sewage calculation) has been accomplished by the recovery measures taken from 1944 to 1952. This is in addition to the 80% prior to reduction.

Recovery from potato starch manufacturing of wet or dried pulp for animal food has been feasible.

Segregation of wastes and removal of products from brewery operations provides brewer's grain for wet or dry cattle feed, spent hops for a soil conditioner, and surplus yeast and proteinaceous materials as a supply of vitamins and meat flavorings in certain foods.

Other Recoveries

Spent grain-press liquor is high in protein, and its use as stock feed is warranted. Formerly, yeast from brewing was wasted, but recognition of its value as food has led to its recovery. There is a potential supply of 43 million pounds of yeast that can be recovered from breweries.

Recovery of byproducts from breweries has resulted in an 80% decrease of population equivalent.

In wineries, separation of clean condenser and cooling waters from the contaminated wastes is recommended. The stillage, which is the most important waste, may be disposed of on land. However, it cannot be used for irrigating grape vines or other crops because its toxicity.

Possible winery byproducts are yeast, tartrates, malic and other organic acids, glycerin, tannin, and potash. Pomace discarded in many wineries contains considerable amounts of sugar and wines that could be recovered. In some wineries, pomace is dried and used as fertilizer or cattle feed. Potash may be recovered by burning pomace. And oil may be recovered from grape seeds.

Where a plant with food waste is situated near a large city, and sewers and adequate treatment facilities are accessible to it, discharge into sewers, after proper safeguards and arrangements, is often advantageous. Where adequate treatment facilities are not available, arrangement may be made for enlarging the municipal sewage-treatment plant to accommodate the wastes.

In many cases, pretreatment at the source is advisable. It may consist of screening (cannery wastes) or removing grease and settleable solids (packinghouse wastes). Equalization and uniform discharges of wastes into the sewer is advisable, especially when large volumes of wastes are intermittently discharged into small municipal sewers.

When dairy wastes are sent into municipal sewers, the dumping of spoiled batches, whey, buttermilk, and skim milk should be avoided.

Relatively few canneries have access to municipal sewers. Those located within corporate boundaries of towns served by sewer systems usually discharge their waste after screening.

Wherever possible, wastes from packinghouses generally go into municipal sewers. This is true after much of the waste materials (grease and blood) are recovered. Under these conditions, they create no difficulty to a sewage-treatment unit, provided it has adequate capacity. Chicago, Ill.; Sioux Falls, Ia.; Fort Worth, Tex.; Fargo, N. D.; St. Paul, Minn.; and Madison, Wis., have adequate sewage-treatment plants for handling considerable proportions of meat-packing wastes.

Separate Treatment

After all of the losses are reduced to a minimum and effective recovery is practiced, there still remain considerable amounts of pollutional materials in food-processing wastes which, unless a municipal sewer is available, must be treated separately to abate pollution of surface waters.

Food-waste treatment is comparatively new. Since 1920, and especially since 1930, a great deal of work has been done in developing new techniques or adapting and speeding sewage-treatment methods for such wastes.

Spray-type irrigation consists of spraying wastes onto cultivated field, forest, or bare ground by the use of a portable piping system, which is equipped with rotating nozzles. The wastes are pumped through the piping system under high pressure, with the feeder pipe permanently placed while the laterals are moved from location to location in a predetermined cycle.

New Digestion Technique

A recent development—treating liquid waste by digestion—is now applied to packinghouse waste. The waste is chemically broken down in a heated digester, and after a 1-day detention period, a 95% B.O.D. reduction is obtained. Effluent from the digester is allowed to settle in a clarifier, and the sludge is returned to the digester.

A similar method was previously employed for treating wastes from plants manufacturing yeast.

The amount of sludge accumulating from digested liquid wastes is influenced by the suspended solids content of the untreated wastes. However, the amount of sludge from food-plant wastes is much greater than from sewage. That's why food-waste sludges are generally disposed by dewatering on sand beds, or by vacuum filtering.

This article was written by H. HEUKELEKIAN, specially for the Anniversary Issue, at the request of the Editors. The author, a well-known authority on sewage and waste disposal, is associated with the Department of Sanitation, Rutgers University, New Brunswick, N. J.

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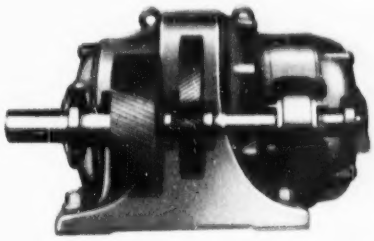

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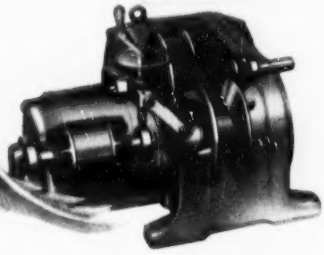

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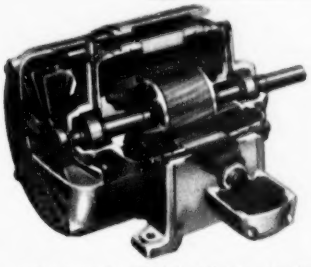

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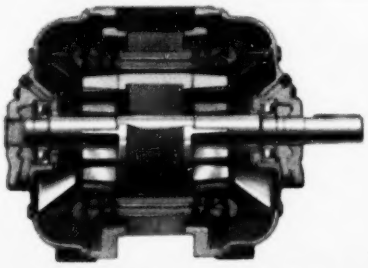

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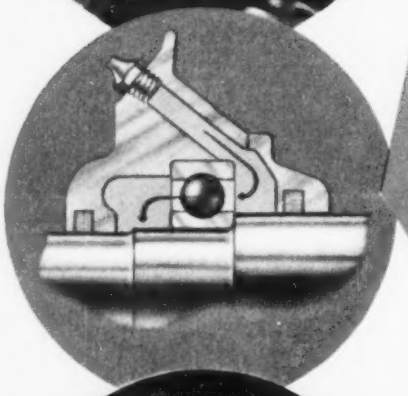

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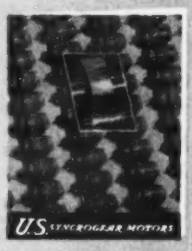

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MOISTURE REMOVAL

ENORMOUS STRIDES in both evaporating and drying of foods have been made during the past three decades.

Indicative of the accelerated activity in this unit operation is the terrific upsurge in the production of citrus concentrate.—Its progress is graphically illustrated on the accompanying chart.

Food manufacturers have impelling incentives for removing moisture from products. Among them are:

1. Food preservation with full retention of the natural flavor and nutritive values
2. A means of reducing overall costs of labor, packaging and transportation of foods
3. Ways to provide greater convenience and time saving for millions of users
4. A method for improving the efficiency of other food processing operations
5. Recovery of an otherwise-waste byproduct

Drying

Two batch-type drying methods have been used for food. In one, heated air moves across the surface of the product in trays or beds in compartments or tunnels. In the other, hot air is circulated through the product. In the former, the drying cycle is long, capacity per unit is low, and labor cost is high, while steam requirement is between 3 and 8 lb. per lb. of water evaporated.

Efficiency is increased by circulation of air through the product. Though labor cost remains about the same, the time cycle is reduced and steam requirement cut to 2½-3 lb. per lb. water removed.

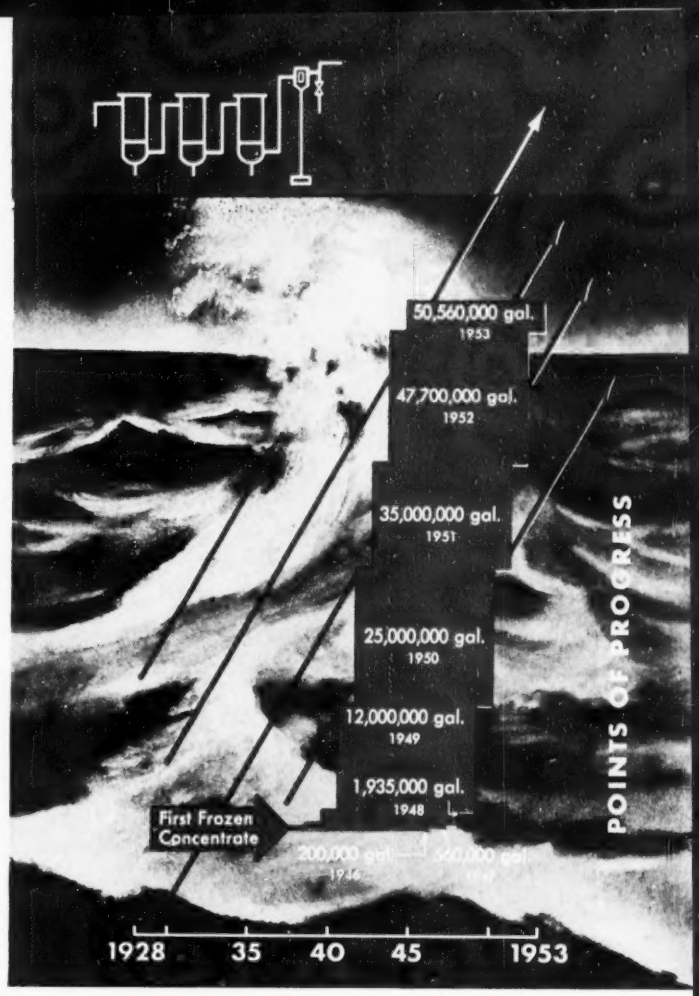
Continuous belt type dryers using through-product circulation of heated air, permit deeper beds and temperature-humidity control, which results in improved quality. Time cycle for drying in this unit is shortened, output per hr. considerably increased, and labor per unit of product materially reduced. Steam consumed is 1.8-2.2 lb. per lb. of water evaporated.

Rotary, Vacuum, and Pneumatic "Flash"

Time cycle is further reduced by direct heated rotary kilns in which heated air passes through the product as it travels through the kiln. One man can attend several units, operating cost of which is generally lower than for the former types.

With a relative capacity three times that of the direct rotary kiln dryer, the indirect heated steam-tube rotary unit is the most economical and efficient of high temperature atmospheric dryers. Cost per ton of water removed should be between $2 and $2.25.

Today, a continuous vacuum operation applied to drying and puffing mint candy, takes place in one or more 90-ft. long steel tubes.



Points of progress are the climbing figures in gallons of citrus concentrate.

Product enters through a pair of air lock valves, travels the length of dryer on a conveyor, and is discharged through another pair of air-lock valves.

Heat for evaporation is supplied electrically. Vacuum, of pump origin, is held in the neighborhood of 6 mm. Drying units are instrument controlled and have a capacity per tube of 200 lb. dry product per hr.

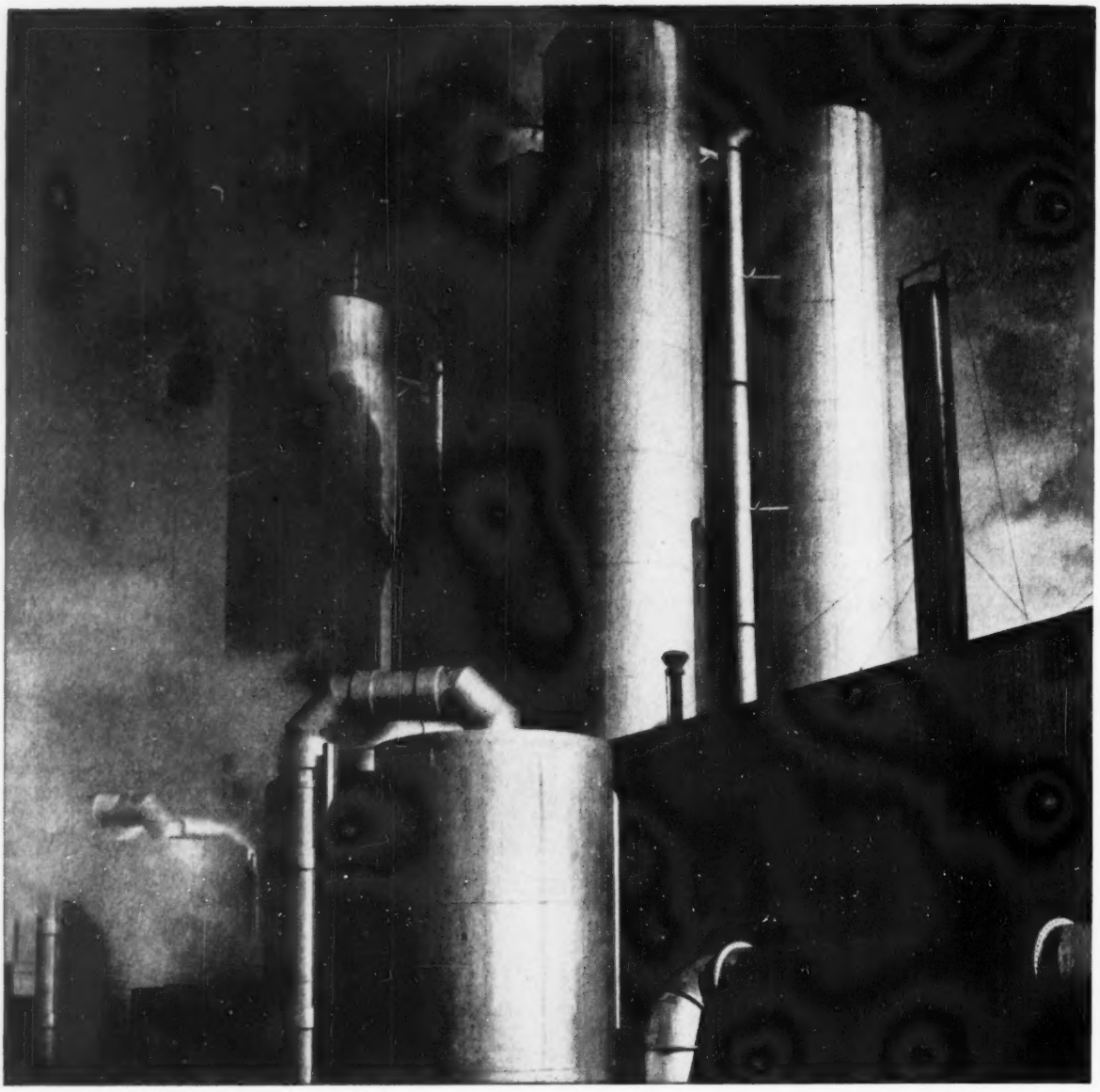
One other drying method, though at present not commercially applied to food, may become important. The equipment in which drying takes place was designed for pulverizing to sub-micron particle size and not for drying. Nevertheless, when foods of particular size, such as green peas, are processed, a dry powder of less than ½% moisture content results. In the operation, peas or other food particles are disintegrated against each other, forced by steam jet pressure to travel at high velocity inside a hollow steel loop. Heat of steam instantly evaporates moisture in product. Evaporation prevents dangerous product temperature rise.

One pilot-plant indication is that chlorophyll and nutrient values remain in the dry product, another is that the economics of the process may permit commercial applications. But the end-product is a powder.

Of the nine major segments of the industry, only one, non-alcoholic beverages, does not employ this unit operation.

The importance of drying is indicated by the facts that between 1930 and 1950 egg drying increased 191 times; milk, 3½ times; vegetable dehydration 24.

Products such as corn gluten, starch, citrus pulp, fish



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meal, etc., are now successfully processed by a method which dries so rapidly that hot gas temperature as high as 300 to 650 deg. F. are successfully employed. Exit temperature ranges between 150 to 210 deg. F.

Material is in contact with hot furnace gas for only a few minutes, during which time rapid evaporation maintains a safe temperature in the heat-sensitive food.

Product is discharged through an air lock into a stream of blower driven hot gas confined in a vertical tube, where most of the moisture removal occurs. Dried product is carried by gas (which has lost temperature to evaporation) into a cyclone separator, from which it is discharged through another air lock.

When particle size is large, as in the case of citrus pulp, the drying tube may be tapered vertically. Reduction in the velocity of gas as tube size increases causes large sized moisture laden particles to be retained until their weight has been sufficiently reduced by evaporation for them to be carried on to the separator. Btu. per lb. of water evaporated ranges between 1,400 to 1,800, with a thermal efficiency of near 70%.

Drum Units and How They Work

Basic aim in the design of food dryers is removal of moisture at highest possible temperature without impairment of quality. Reducing the time cycle to a few minutes, and often less, has permitted relatively high temperatures for heat sensitive foods.

Due to the high ratio of surface to volume of product dried by drum and spray drying methods, evaporation is so rapid at the elevated heat level that the temperature of many heat sensitive foods never reaches the danger point.

A thin layer of product to be dried (at atmospheric pressure) is spread on the surface of an internally, steam-heated hollow roll (or pair of rolls). Speed of cylinder rotation is variable-speed controlled. Labor required is one man for each pair of dryers.

Usually within a 30 to 60 sec. period, product, in dry form (1 to 4% moisture content), is removed from the drum surface by scraper or "doctor." Seldom does the product reach drum temperature—if ever, only during the last few seconds before reaching the scraper. Rate of evaporation ranges up to as high as 17 to 19 lb. of water per sq. ft. surface per hr. Steam consumption usually averages between 1½-2 lb. per lb. water.

When, for the most heat sensitive foods, it is necessary to dry at a lower temperature or in the absence of air, the drum or drums are enclosed in a tightly sealed vacuum chamber.

Where their application is suitable, drum dryers are in favorable use because:

1. Operating temperature is relatively low.
2. Time during which product is heated is short.
3. Low pressure or exhaust steam is suitable.
4. Labor cost is nominal.

Spray Dryers

Converting milk to a readily reconstituted dry powder was the major incentive for the development of efficient spray dryers.

In commercial installations, the solution or slurry to be dried is atomized (2 to 500 microns) either by high-speed centrifuges (6,000 to 20,000 rpm) or high-pressure nozzles (2,000 to 10,000 psi.) into rapidly circulated atmosphere of heated air (280-300 deg. F.). Evaporation from the atomized mist takes but a fraction of a second. Overall time in the dryer usually is under 30 sec.

Most of the dry product (1-3½% moisture) falls to the bottom of the spray chamber, where in modern installations it is continuously removed. Particles entrained in exhaust air are collected in some type cyclone or dust collector.

Here are the major assets of spray dryers, in which approximately 7 billion lb. of milk are dried per year:

1. Versatility
2. Control of moisture content to low percentage
3. Application to heat-sensitive foods
4. High product recovery.

Three New Vacuum Dryers

First of these has proved effective for heat sensitive liquid foods and slurries.

Unit consists of a vacuum chamber in which liquid to be dried is first deaerated and then transferred in a thin film to a replaceable stainless steel belt. Latter passes first around a steam heated drum and next around a chilling roll. Cooled dried product (1 to 2% moisture) is removed from belt by scraper.

Steam-jet-produced vacuum of 5 mm. Hg. abs., employed for application of the unit to drying a 38 to 40% coffee concentrate, removes water at the rate of 105 lb. per hr. Heating and drying time on the belt, with travel rate of 50 ft. per min., is approximately 13 sec.—total time-cycle up to scraping product from the belt is 27 sec. Capacity of this unit is put at 65-70 lb. of soluble coffee per hr.

Vacuum Drying Frozen Drops

Second and most recently developed method of drying liquids and slurries starts processing by freezing the fluid into drop-sized particles and then, with the aid of radiant heat and vacuum, removes the moisture from the frozen drops. Method is now commercially applied to drying coffee and other heat sensitive organic products.

Fluid to be dried (after first concentrating in the case of instant coffee) is ejected, in pellet size globules, into inert high-density freezing medium which is Freon chilled to between −40 and −55 deg. F. As they are frozen, pellets rise to the top of the unit where they are separated from the freezing medium.

In a closed system, pellets are then delivered to an air-lock, where under vacuum all freezing medium is removed. From the air-lock, pellets move to a second chamber, discharge from which spreads them onto a series of belt conveyors on which they travel through the dryer or sublimator. Heat for evaporation is supplied by instrument controlled infra-red radiation.

In the drying chamber, a vacuum (of pump origin), is applied as required to as low as 5-6 mm. Hg abs. Water evaporated is condensed alternately in one of two −40 deg. F. Freon refrigerated tube-shell condensers.

The drying system enjoys these advantages:

1. It provides a continuous system of "freeze-drying" or sublimating moisture from heat-sensitive products.

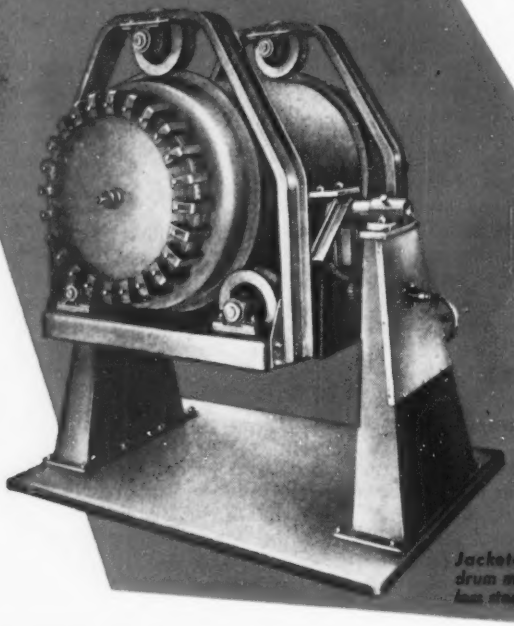
2. Reduces costs of formerly expensive method of drying from the frozen state, partly due to the continuous instrument-controlled nature of the process and partly because of the efficiency of the method of applying heat for evaporation.

BACK IN THE 1880's

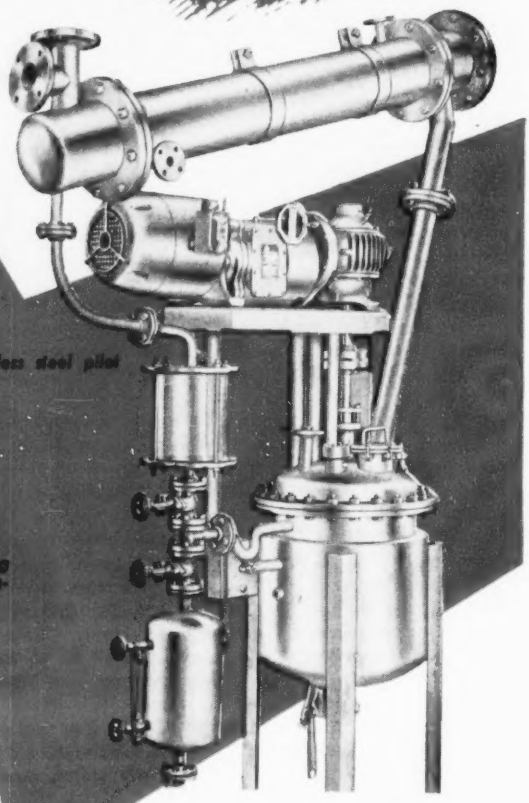
WHEN GERONIMO WAS ON THE WARPATH

Koven

WAS MAKING INDIVIDUALIZED FOOD EQUIPMENT



Jacketed revolving drum made of stainless steel



Stainless steel pilot plant

When the pioneering Southwest was fighting Geronimo and his hordes of Apaches, KOVEN was pitting its engineering skill against production problems with individualized food equipment. Today, KOVEN, one of the country's leading steel fabricators, builds Individualized Food Equipment to the precise needs of food manufacturers—to maintain their highest production standards at lowered costs. Call or write for a consultation—no obligation.

Complete modern facilities including X-ray inspection and stress relieving which insure quality control. KOVEN equipment in all commercial metals and alloys include: pressure vessels, extractors, mixers, stills, condensers, kettles, tanks, chutes, containers, stacks, breechings, coils. Fabrication to A.S.M.E. Code Par. U-68 and U-69 a specialty.

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3. Whether end-product is left in friable pellet form or powdered, quality is high.

"Puff"-Drying

The last of the three new drying methods, developed in the Western Regional Research Laboratories, also operates at vacuum pressures. Process has been applied successfully to batch drying juices such as grape, apple or pineapple, and those of the citrus fruits. Conversion of the method to continuous operation is expected.

By vacuum evaporation, a 6-fold, viscous (60-65 Brix) juice concentrate (50% soluble solids) is prepared and distributed to shallow trays, which are placed on hollow shelves or tubes in the dryer. By circulating steam, cold water or refrigerated brine in the shelf or tube arrangement, juice in trays may be either rapidly heated or cooled.

During the first part of the drying cycle, when cooling effect of evaporation is maximum, drying is conducted at a relatively high temperature (200 deg. F.). Product temperature, however, does not exceed 125 deg. F.

As drying progresses, temperature is lowered to avoid undesirable flavor changes. Product is maintained under 125 deg. F. by circulation of cooling water even when moisture content is lowered to 3%. End-temperature of 80 deg. F. is obtained by circulation of refrigerated brine. The vacuum that is held throughout moisture removal is ½ mm.

Final puffed, sponge-like, friable product, which is readily converted to a powder, is dried from a ¼ in. film in approximately 1 hr.

Recommended procedure to reduce cost of extracting last few percent of moisture is to remove product from dryer when moisture content is down to 3%. Final lowering, to less than 1% is accomplished, after product is packaged in hermatically sealed containers, through aid of a desiccant (CaO) enclosed in the container in its own sift-proof, moisture-permeable package.

Concentrating

Though "boiling down" still maintains a nitch of importance, modern continuous processing of foods limits open kettle moisture removal to dwindling applications.

Recognized economic advantages of continuous evaporating, long employed for processing sugars and salt, have been impressively reconfirmed by new applications within the last decade. Not only has straight line flow, push-button-automatic processing of jams and jellies resulted in assured product uniformity, but labor requirements for operating large installations has been reduced from 14-16 "artisan cooks" to a mechanic and helper (FE Sept. '51).

Less than 25 years ago, the amount of processing labor (mostly hand) employed for single strength citrus juice canning was accepted (probably belligerently) as an unavoidable cost per case increment. At that time, in the average juice canning plant, 30-33 workers produced 1,500-1,800 cases of 24, No. 2 cans per 24 hr., a production rate of 210 to 260 gal. of juice per hr. Labor of workers included all operations from receiving to hand casing.

Low Temperature Evaporation

Today, in one of the frozen orange juice concentrating plants, one man operates two continuous, instrument-controlled evaporating units. Raw-juice in-put capacity of the two is 5,000 gph. More processing steps are required on this frozen concentrate line than on the juice line. Nevertheless, only a few other workers are employed (for preparation and finishing) to produce this 20-fold increase in production rate.

With continuous processing has come material improvement in the quality, as indicated by consumer acceptance.

Concentrating orange juice at temperatures of 75 deg. F. or less provided the impetus which in less than 10 years, has introduced greater advances in the design and control of evaporators than have occurred in the entire past century.

Since frozen concentrated orange juice made its first public appearance, method of processing of the product has been successfully applied to concentrating other juices and also milk. Meanwhile, pilot plants are operated around the clock adapting low temperature concentration to other foods.

Here are some of the characteristics of the new low temperature systems:

1. Heat is applied in the evaporators through groups of long corrosion-resistant metal tubes.
2. Liquid is exposed to the heating surface in a thin falling film.
3. Energy for heating is conserved by multiple effect or multiple stage.
4. High vacuum is employed, generally 8-20 mm.
5. Vapor from last effect is made condensable by means of some type recompression.
6. Separation of entrained liquid is practically complete in efficiently engineered "flash" chambers.
7. Automatic control is maintained through extensive instrumentation.

In the space of a few years many systems have been engineered, each with major advantages, depending on type of product and local conditions. A high-spot description of a few of them will indicate the flexibility of the new concentrating systems.

In areas where water is plentiful and economically obtained, and where fuel costs are not excessive, steam evaporating systems are advantageous. Two general methods are in favor, each boasting its own refinements and special advantages.

Multiple—Effect Evaporators

Both double and triple effects are employed. Due to the low range of evaporating temperatures, negligible economy is gained by additional effects.

Vapor from the juice leaves the flash chamber of the last effect at a temperature of 50-52 deg. F. Through recompression by means of a steam booster, temperature is raised to 80-90 deg. F., superheat regulated by instrument-controlled water injection.

Recompressed juice vapor provides heat for evaporation in the first effect, vapors from which supply heat of evaporation in the next effect.

Excess vapor from the last effect, above that required for heating the first effect, is steam-booster-recompressed enroute to a barometric condenser. Temperatures in the different evaporators range between 50 and 75 deg. F.

Another all-steam evaporating system employs but a single effect operated in three stages.

(Turn to page 287)

▸ Egg Drying Multiplied 191 Times
▸ Spray-Dried Milk Skyrockets
▸ Heat Pumps Now Prominent

Here's a One-Man Bulk Materials Handling System for Your Plant...

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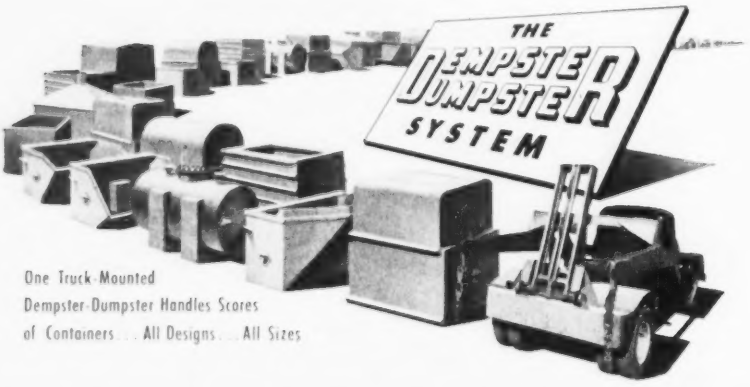
Without question, the Dempster-Dumpster System is the most economical and most efficient method of plant materials handling by truck ever devised!

Write to us for complete information. Manufactured exclusively by Dempster Brothers, Inc.



One Truck-Mounted
Dempster-Dumpster Handles Scores
of Containers . . . All Designs . . . All Sizes

DEMPSTER BROTHERS, 7103 Shea Bldg., Knoxville 17, Tennessee

SEPARATION

ADVANCES in separating operations have contributed tremendously to the great 1928-1953 growth of the food industry by improving product quality, reducing labor costs, and increasing yields.

This has been brought about by a combination of new and improved equipment and better processing methods. The "switch to continuous" in many food processes was made possible only because improved separating equipment became available. A notable example is the nozzle-discharge centrifuge.

Centrifuging

The first nozzle-discharge type of disk bowl centrifuge was developed about 1928, but was not applied to food processing for a number of years.

In previous machines, solids were deposited on the inside of the bowl, necessitating frequent shut-downs for manual cleaning. This limited their use to products such as milk that contained small amounts of solids.

With the new centrifuges, solids were discharged continuously through nozzles equally spaced around the outer wall of the bowl. This notably extended the operating period of units and, also, opened up many new avenues for their application.

In 1932 a nozzle-discharge centrifuge was introduced that had been especially designed for handling liquids containing large amounts of solids and for separating and washing the solids continuously.

In this unit, continuous separation is accomplished by discharging a concentrate through nozzles in the bowl, then returning a major part of it to the bowl at the zone of discharge.

This action creates, at the periphery of the bowl, a turbulence that keeps the solids in suspension. At the same time is serves to build up density of the concentrate to any desired degree so long as it flows.

Washing of solids is accomplished by addition of liquor to the concentrate as it re-enters the bowl. If wash is limited to the exact amount of liquid required to carry the solids out of the system, original carrying liquid will be displayed.

If more wash is introduced, the excess flows inwardly to an overflow discharge weir against settlement of solids in the bowl, producing counter-current washing of solids.

Although developed to completely replace starch tables, the first installation of the new centrifuges was on tailings from the tables. This use resulted in such an increase in starch recovery and improvement in quality of gluten that all major starch producers quickly adopted centrifuges for this operation.

Oil Recovery Increased

Continuous refining of vegetable oils, with its increased yields and better quality, is another example of improved processing made possible with centrifuges.

Introduction of the continuous caustic soda refining process in 1932 reduced oil losses by more than 26%. In this process, oil is treated continuously with a metered amount of caustic solution. Break is produced by passing the emulsion through a low-pressure steam heater where the temperature is raised to 140-160 deg. F. Oil is separated from soapstock, mixed with hot water, and separated from the washwater, each operation being accomplished by high-speed centrifuges.

Points of progress are applications of centrifuges to food separating operations.

Also in the mid-'30's improvements were made in vertical, basket-type centrifuges used in sugar refineries. Speed of rotation was increased from 1,200 rpm. to 1,800—in some cases 2,200—resulting in more complete removal of molasses from sugar crystals. Less wash water was required and, therefore, less sugar was dissolved to be recovered later by reprocessing this water.

Automation moved into the sugar refinery at about this time, resulting in the installation of semi- and fully-automatic basket-type centrifuges. In these installations, a number of the operations previously performed manually were shifted to an automatic cycle. In some cases, the machines can go through their normal cycles without attention from the operator.

Centrifuging made an additional contribution to the dairy field with the introduction, in 1936, of the closed clarifier. With the introduction of homogenized milk, a muddy sediment appeared in the bottoms of bottles. This consisted of leucocytes that could only be removed by high centrifugal forces. So centrifuge manufacturers developed air-tight units that eliminated foaming, spillage, and exposure to air—major objections of the previously available ones.

It was during and after the war when centrifuging

- Space Cut 92%, Labor 75%
- More Oil Filtered With Less Work
- Fruit Extracted at 480 a Min.

really hit its stride. Numbers of applications zoomed, but far more important were the keyroles these applications played in the switch to continuous, low-cost processes.

To name a few: Complete separation of starch from gluten in wet milling without tables would not have been possible except for introduction of nozzle-discharge centrifuges. First complete installations, for wheat in the late '30's, for corn in '42, effected such large savings and improvements in quality that all of the big wheat starch plants and a majority of the corn refineries have now adopted the system.

Benefits from replacement of starch tables by centrifuges in a plant grinding 20,000 bu. of corn per day are listed in an accompanying table. Improvement in product quality is yet another advantage.

In 1944 centrifuges found money-saving applications in the previously untouched meat packing field, and additional ones in fish packing.

Units had been used in fish reduction plants since 1935, and in recovery of oils from fish livers. The new applications were: (1) Continuous production of high quality steam rendered lard, and (2) recovery of oil from fish stickwater.

In the former process, high-fat stock that has been finely comminuted and raised to a high temperature to effect rapid rendering is pressed to remove liquids from solids. Fat is separated from water and fine solids by high-speed centrifuges that periodically discharge a solids-water sludge. Resulting lard is very high in quality, extremely low in fatty acids, almost neutral in color and odor.

In the stickwater process, liquid discharged from fish reduction plants is acidified to coagulate proteins and enzymes, which are then removed by means of a clarifying solid-bowl centrifuge. Temperature of stickwater is raised to melt fat that was liberated from coagulated solids. Oil is separated from water with a nozzle-discharge centrifuge. This process has solved urgent water pollution problems and brought monetary returns from recovered oil and high-in-vitamin condensed solubles.

Dairy Applications Increase

Also in 1944 a new centrifuge made possible production of cream cheese on a continuous basis. Previously curd was placed in bags to permit the whey to drain off. With the new method, separation was continuous, instantaneous, and more complete. Quality was improved, there were big savings of labor and floor space, and sanitation progressed.

Further advances in separating and processing resulted from introduction in 1948 of three improved dairy centrifuges—a standardizing clarifier, base curd machine, and a butter oil concentrator—and in 1949 with the cold milk separator.

The standardizing clarifier removes a controlled amount of fat from milk. It differs from a regular disk-bowl clarifier or separator by having two sets of distribution holes in the disks. Holes near the center separate a portion of the milk into cream and low-test milk. Cream moves to the center of the bowl and is discharged. Low-fat milk flows down the top of the disks and joins the stream of whole milk that has been fed through the outer distribution holes.

Three specific benefits are obtained: (1) Higher quality milk; (2) savings in labor, time, and equipment, and (3) extra profits from sale of cream recovered.

The new curd separator has orifices in the periphery of the bowl through which curd or heavy skim, that packs in the bowl of conventional separators, is discharged continuously.

This machine is used to separate curd from skim milk products, such as baker's cheese.

The butteroil concentrator comprises a special nozzle-discharge bowl and disks that enable production of cream with 90% or higher butterfat content with continuous discharge of curd that permits extended operation without shutdowns for cleaning.

In one continuous buttermaking operation where the new type machine is used to convert 40% into 90% cream, labor was reduced 70% and floor space an equal amount as compared with the conventional churning process it replaced.

Fruit Juice Clarified

Design changes in the bowl of a standard "air-tight" cream separator made possible efficient separation of milk at temperatures as low as 40 deg. F. Previously, a minimum of 90 deg. had been required. In addition to savings in fuel, refrigeration, and labor, less auxiliary equipment is needed. Quality of resulting cream is likewise improved.

Also in 1949 continuous, partial clarification of pineapple juice became a reality by employment of improved valve discharge centrifuges.

Previously, juice of desired solids content (16-18%) was obtained by cutting back the 24-28% product, from paddle finishers, with filtered or centrifuged juice.

When a supercentrifuge was used, labor required to remove pulp from the bowl amounted to 1 man-hour per 300 gal. Substitution of valve- or nozzle-discharge centrifuges that remove excess pulp and continuously deliver juice of desired solids content reduced labor to 1 man-hour per 15,000 gal. Also removed by the improved process are all dark fruit eyes, tramp metal picked up from previous processing units, and other extraneous materials.

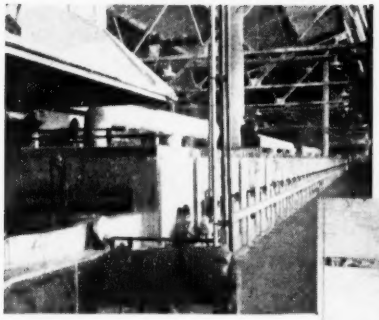
Used for Beer and Lard

In 1950, came the first U.S. commercial installations of centrifuges for clarification of hot wort, and for partial polishing of beer. Their present successful use in several large American and Canadian breweries is though to presage many more installations in the next quarter century.

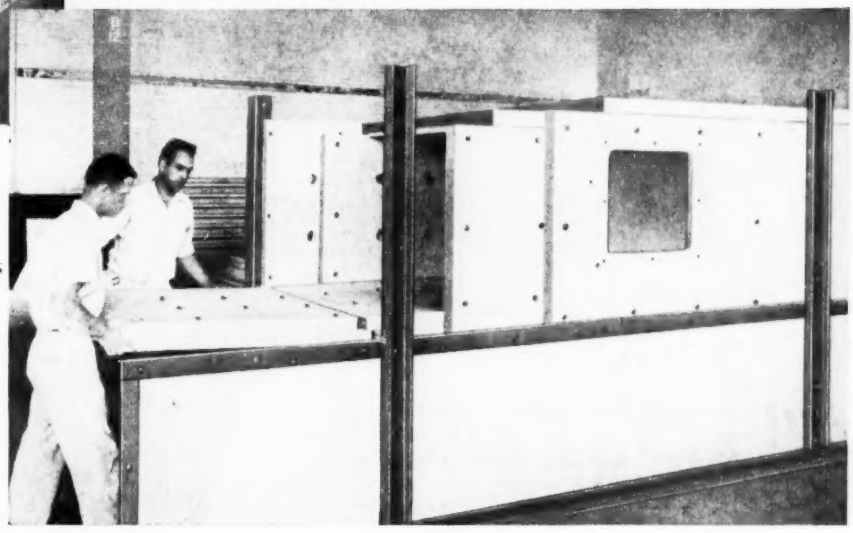
Centrifugal separation found three new uses in the meat field recently. Continuous, solid bowl horizontal centrifuges are now used in the handling of packing house wastes. Their use results in recovery of a relatively dry

Tables Replaced—Notable Gain

	Using Starch Tables	Using Centrifuges	Percent Change
Floor space	69,000 sq. ft.	7,500 sq. ft.	—92
Labor	4 men/shift	1 man/shift	—75
Water			00
Power			00
Investment			00
Yield	85-90%	95+	+5



Typical band oven built with Marinite insulation. Insulation engineering by Johns-Manville.



Mechanics assembling a Marinite bakery oven. Marinite is used both as the structural and insulating material.

Modern bakery band ovens are *Built* and *Insulated* with one material . . . J-M MARINITE

When leaders in the baking industry look for ways to improve band-oven performance, they realize that efficient insulation is a primary requirement. Johns-Manville provides the answer to this need with J-M Marinite*, the *structural* insulating material. Marinite improves band-oven performance in three important ways:

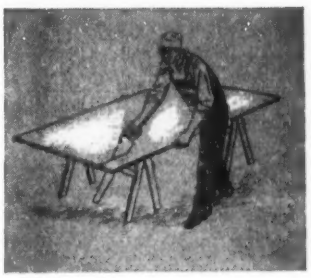
1. Cuts fuel bills—because it is an efficient thermal insulation . . . heat loss through Marinite oven walls is very slight. Fuel savings are substantial, for ovens of this type operate 24 hours a day, at temperatures up to 700F.

2. Improves temperature control—because it eliminates almost all through-metal fasteners and reduces the need for structural supports. Marinite construction provides uniform temperatures throughout the oven without local hot spots.

3. Reduces maintenance—because it is entirely unaffected by the high humidity and corrosive organic gases commonly prevalent in band ovens. Installation costs are also lower than with former methods of construction.

The Marinite oven installation illustrated here is but one example of how Johns-Manville insulating materials and Johns-Manville insulation engineering services are teamed with industry to develop improved processes and more efficient equipment. If you would like more information about Marinite Insulation and its application to your product or plant equipment, write Johns-Manville, Box 60, New York 16, New York. In Canada, 199 Bay Street, Toronto 1, Ontario.

*Reg. U. S. Pat. Off.



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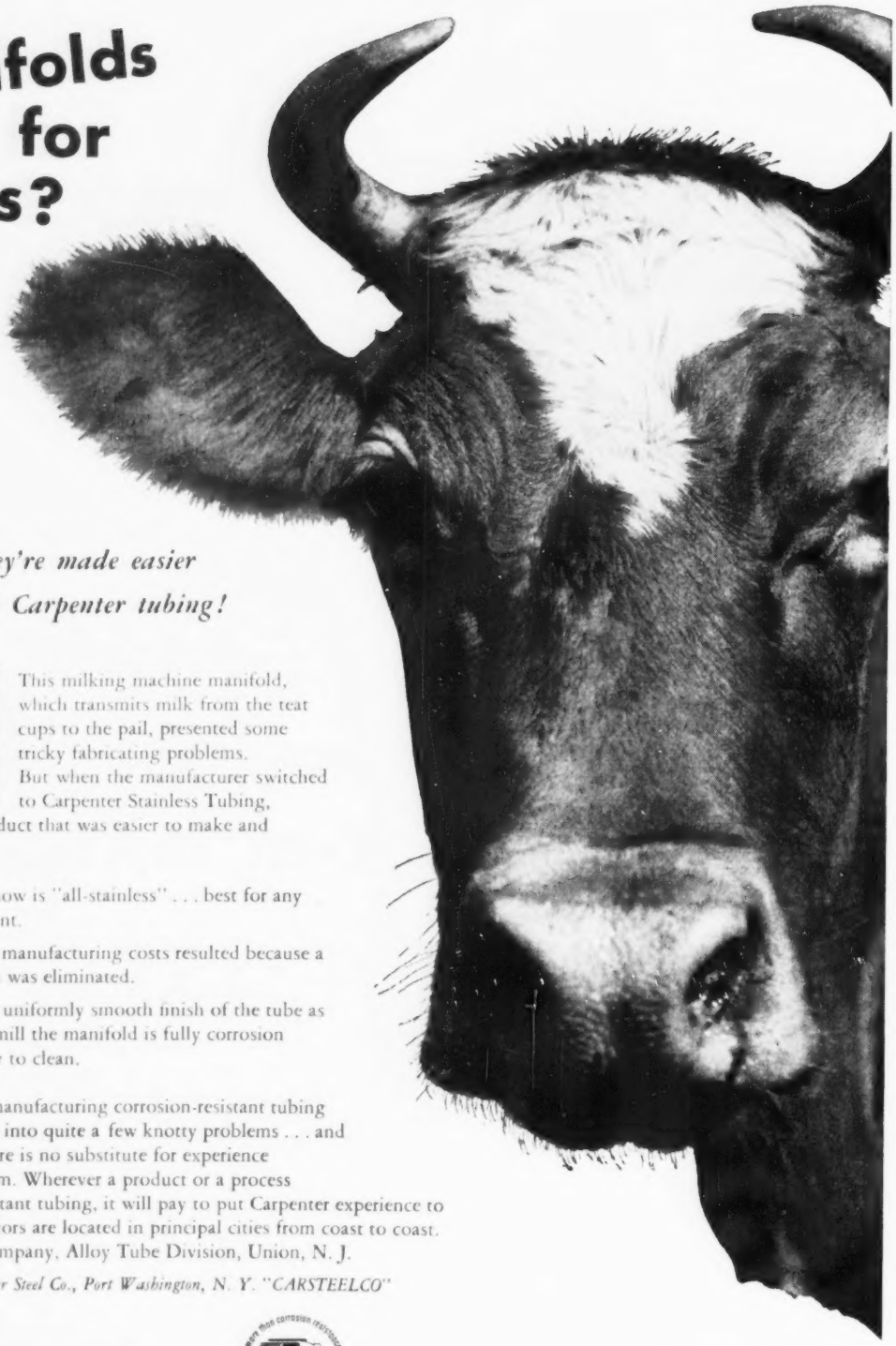
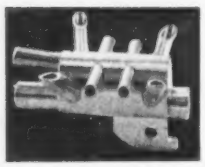
For more information, use coupon on page 207.

manifolds for cows?



Sure . . . and they're made easier and better with Carpenter tubing!



This milking machine manifold, which transmits milk from the teat cups to the pail, presented some tricky fabricating problems. But when the manufacturer switched to Carpenter Stainless Tubing, he came up with a product that was easier to make and easier to keep clean:

- the manifold now is "all-stainless" . . . best for any sanitary equipment.
- real savings in manufacturing costs resulted because a plating operation was eliminated.
- because of the uniformly smooth finish of the tube as supplied by the mill the manifold is fully corrosion resistant and easy to clean.

When you have been manufacturing corrosion-resistant tubing for 25 years, you bump into quite a few knotty problems . . . and we have found that there is no substitute for experience in solving many of them. Wherever a product or a process involves corrosion-resistant tubing, it will pay to put Carpenter experience to work for you. Distributors are located in principal cities from coast to coast. The Carpenter Steel Company, Alloy Tube Division, Union, N. J.

Export Dept.: The Carpenter Steel Co., Port Washington, N. Y. "CARSTEELCO"

Carpenter

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tankage of high protein content, and a higher percentage of grease than by the batch method.

In 1952, a further advance was the continuous centrifugal lard refining process. Here, comminution, improved heating, and centrifuging were combined to continuously remove fat from tissue. Floor space was reduced 94%, power 95%, labor 84% and yield was increased 20%. Quality of finished product was enormously improved.

Impulse Rendering

Still another application is in the cold extraction of fats and oils from cellular tissues, such as bones, by impulse rendering. Material is suspended in a stream of cold water that is subjected to a series of high-speed, high-frequency mechanical impulses. Fat cells are instantly ruptured and fat rises to surface of water, from which it is separated by nozzle discharge centrifuges. Final polishing is by supercentrifuge. Recovered fat is white, bland, solid, and of high purity.

Big news in the sugar field is a continuous centrifuge now employed in raw-sugar houses and undergoing tests in refineries. Due to the elimination of stops and starts, power requirement of the new centrifuge is less than 10% of conventional units. And since there is no cycling, labor is cut more than 50%.

Centrifuge is comprised of two rotating baskets, one for purging, one for washing and drying. Each is driven by an individual motor.

Magma is fed continuously to center of purging basket, where a funnel-shaped baffle accelerates and discharges it to a cone-shaped perforated basket. Here, molasses is separated from sugar crystals, which move over the edge of the cone and into an outer, funnel-shaped, perforated basket, where they receive sprays of clean water, followed by spinning. Washed sugar is discharged over lip of cone.

Filtering

In the early '30's a vertical pressure filter was introduced that was much more compact and simple to operate than the previous units. It was designed specifically for easy cleaning and sterilization, and quick discharge. Also, the ratio of filter area to filter volume was greatly reduced.

This unit is comprised of a series of double faced, rectangular, screen assemblies (leaves) suspended in a pressure vessel. In operation, unfiltered liquid is pumped into vessel and forced through the fine mesh screen (a precoat of diatomaceous earth may be applied). Filtrate flows to leaf frame and out through manifold.

The fine screen (with more than 2,500 openings per sq. in.) made unnecessary the old type cloth coverings. This, and ease of cleaning brought real economics, which resulted in this type filter replacing others in a number of fields, including breweries, wineries, fruit juice plants, and vegetable oil refineries.

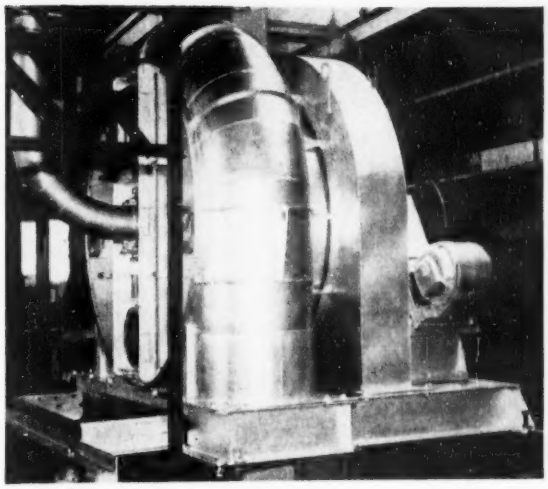
At about the same time several other vertical filters were introduced featuring horizontal plates that are nested in a series. Some units employ filter papers, and all are fed through a center shaft, thus eliminating pressure on the shell. They are applicable to products having solids contents below 1%, such as fruit juices, cider, and beer.

Difficult Products

A special precoat filter was introduced in 1937 for clarification of solutions containing colloidal matter, fine particles in suspension, or sticky and gummy solids. In short, the unit was developed to handle products that were difficult, or impossible, to filter by any other means.

Essential difference between this unit and the usual drum-type filter is in the pre-forming of a thick cake of microporous permeable material by filtering a slurry of diatomaceous earth suspended in a clarified liquid. Then, material to be filtered is fed continuously to the filter tank. As the drum rotates, liquid is sucked through the precoat cake, leaving a thin layer of solids on the surface. A moving knife edge continuously shaves off the deposited solids plus a thin section of the precoat—usually 0.0005-0.0002 in.

This unit is employed for filtering cane and corn syrup, pineapple juice, milk sugar solutions, seaweed extractives, coffee, meat and liver extracts.



PACESETTER for tomorrow—continuous sugar centrifuge.

Aid Oil Recovery

Introduction of the horizontal rotary filter in 1946 and an improved horizontal pressure-leaf filter in 1950 were definite milestones in postwar filtration.

Unlike most mechanical filters, the rotary filter utilizes the force of gravity. Vacuum required is only that necessary to remove the liquid from the cake, so power requirements are very low.

Unit consists essentially of a pan into which are set wedge-shaped filter sections with outlets to a common valve in the center of the pan. Pan is supported on a large ball race and rotated by a special chain drive. Through the valve in the center, vacuum or pressure is applied to the filter sections. Material to be filtered is pumped or fed by gravity. As the pan revolves, filtrate passes through filter medium to center valve, then to vacuum receiver. Meanwhile, solids have built up in cake form and are washed and/or dried, then discharged by means of a scroll or paddle wheel. (*Turn to page 212*)

Coming Tomorrow:
Simultaneous Precipitation-Separation

Many new applications for separating processes and equipment are seen during the next 25 years.

Centrifuges will continue to improve processes. Precipitation will be simultaneous with separation. Automatic sorting, for both size and color, will be applied to many more products—especially electronic sorting.

Long before 1978, precipitation and extraction by ultrasonic energy will be practicable. And there will be many more applications of electrostatic separation in dry-materials processing.

SAFE REFRIGERATION
in the Food Industry

How novel quick-freeze solved 6-day delivery schedule for bakery on 5-day week!

Clad in Arctic garb, assistant (at extreme left) in Wheatality Baking Corp. plant stores overproduction of baked goods in frigid holding room . . . building up for deliveries when bakery is shut down. Inset shows compact refrigeration unit nearby.

5-ton system charged with a "Freon" refrigerant helped boost production and lower costs

When the Wheatality Baking Corporation, New York, went on a 5-day week some time ago, it was necessary to adopt a stagger system so that fresh-baked goods could be delivered to more than 2,000 customers six days a week. This proved unsatisfactory, however, because absent experienced employees had to be replaced by less experienced workers. Product uniformity suffered; production slowed; morale reached a low ebb.

In solving the problem, company officials turned to refrigeration. It was decided to build up inventory during the 5-day week and by freezing deliberate overproduction of baked goods, create a usable surplus. Tests covered a six months' period. Freezers held at temperatures ranging from 20°F. down to -30°F. were tried. Best results proved to be a quick-freeze at -10°F. and a holding temperature of 10°F.

The idea worked so well a sizable freezer room was constructed of concrete lined with 6-inch cork insulation. Refrigeration equipment of 5-ton capacity, operated with Du Pont FREON-12® fluorinated hydrocarbon refrigerant, maintains the desired low temperature. Automatic defrosting-type blowers are used and slat-type shelving permits circulation of cold air in the freezer.

Because several thousand dollars of merchandise are stored toward the end of the week, protection of the goods demands refrigeration of the utmost dependability. Elsewhere in the plant other installations of 25 tons total capacity serve dough retarders held at from 36° to 38°F., with relative humidity at 80 per cent . . . ingredient storage rooms . . . and also provide air conditioning for offices. In addition, the bakery produces a quick-frozen cream cheese cake . . . popular in many markets.

Here again is an example of how the food industry is using refrigeration as a modern production tool. There are thousands of other applications in processing, handling, shipping, storing and retail selling. For most of these, engineers wholeheartedly recommend the installation of equipment charged with "Freon" refrigerants. There is good reason why. These refrigerants are safe . . . noncombustible, nonexplosive, virtually nontoxic, and as pure as exacting, laboratory-controlled methods of manufacture can produce. Why not review the subject of refrigeration (and air conditioning) with your own engineers? Perhaps these twin tools of industry can help you solve a production problem or improve a method of operation within your plant right now. E. I. du Pont de Nemours & Co. (Inc.), "Kinetic" Chemicals Division, Wilmington 98, Delaware.

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SAFE REFRIGERANTS

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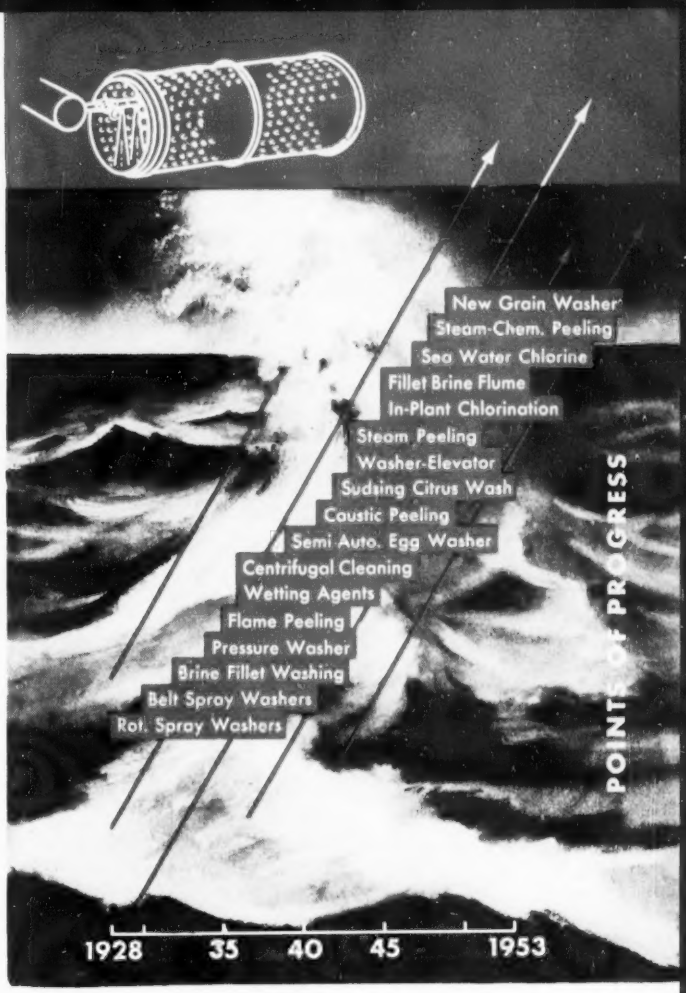
WASHING AND PEELING



Points of progress are improvements in equipment and methods for washing and peeling foods.

FROM the rather crude methods and equipment used 25 years ago for washing and peeling of raw materials, the food industry has come a long way.

Fruit and vegetable washers have been redesigned to do a better job more efficiently. And removal of dirt and extraneous matter from grains by washing prior to milling is far more complete.

To aid the improved washing equipment, wetting agents that get under the soil and practically lift it off the products have been developed, and in-plant chlorination has been adopted.

Peeling, too, has advanced from a hand operation to an automatic one. Here, steam and chemicals have done their part to assist the improved units.

Wetting Agents Come In

In the late '30's, washing compounds were developed which contained wetting agents. These cleaners slightly penetrate the skin of a product and remove the dirt without reducing protection afforded by the skin. They enable cleaning solutions to penetrate the waxy outer layer of products and destroy spores and bacteria.

Effectiveness of in-plant chlorination was demonstrated about five years ago in several freezing plants. It reduced bacteria counts of cut beans 35% from 440,000 per g. to 285,000. For French style beans, a count of 570,000 per g. was lowered to 250,000—a reduction of 56%.

This method produces a higher quality product and is now widely used in canning, freezing and fishery operations. An Eastern fish packer has four electrolytic cells which generate chlorine from sea water. With these he is able to produce the chemical as it is needed for in-plant chlorination requirements.

Wet cleaning of grain for milling received a decided boost with introduction into this country about two years ago of an improved washer and stoning machine. It comprises a water-filled trough fitted with horizontal washing- and stoning-worms, float-off device, and a rising worm set at a slight angle.

Cleaning is effected by the washing worm as it moves grain the length of the trough. At the same time, stones, earth, sand, iron, and other heavy impurities fall into the stone worm and are conveyed out of the trough. Grains are discharged into a rising drum where lighter materials float off. Heavy, moist grains sink to the bottom and are picked up by the rising worm. As they move up the incline, the dirty water drains away, then grains are rinsed with fresh, clean water and, finally, are discharged to a whizzer.

To increase the capacity and improve efficiency of tomato canning lines, a machine combining three separate cleaning operations was developed. This unit has a water boot, into which tomatoes are dumped. A stainless steel roller conveyor moves them from the boot and under water sprays of 250 psi. then past inspectors. Rollers turn the tomatoes continuously, finally moving them through the scalding section where skins are loosened by jets of steam.

More recent developments in peeling are the steam pressure and steam pressure-chemical type units. These advances over lye or abrasive peeling provide automatic operation and a 10-15% increase in product recovery.

In the former unit, vegetables and some fruits are fed automatically into a feed valve, thence into a screw conveyor operating in a cylinder and under steam pressure. The skin is loosened by steam penetration. Then the product is discharged through an exit valve.

With the latter unit, the product is first immersed in a water bath, then is chemically coated. It is automatically transferred through a valve to an open pocket of the steamer turret and, as this turret revolves, steam under pressure is applied. The combination of chemical and steam serves to loosen or disintegrate the skins. Product is discharged through an exit valve into the skin eliminator or washer.

Concerning the Future

Projected design of new cleaning equipment is aimed at lower labor costs, more efficient performance, and improved sanitation. Greater use of automatic control and non-corrosive metals will help to achieve these goals.

And before 1978, ultrasonic washing likely will be used on food materials.

what's **corn** doing at the north pole?

CORN PERFORMS VITAL FUNCTIONS... IN MANY UNEXPECTED PLACES

Wherever modern man goes... corn follows him in one form or another. Corn is with him in his food in many forms, including corn syrup, starches and energy-giving dextrose. Corn sugars helped tan the leather in part of his clothing. Specialized corn starches helped cast the molds for much of his metal equipment. These are but a few of the numerous examples of how continuous basic research in corn helps a host of industries... helps you.

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For more information, use coupon on page 207.

SIZE REDUCTION

AGE OF SPECIALIZATION in size-reduction techniques did not begin until the early 1920's.

Today, there are machines for processing many kinds of foods and beverages. With these units, nearly any particle size and many shapes may be produced.

The growing utilization of these machines did not occur through mere coincidence. Instead, it has resulted from a food engineering concept that has produced new processes and refined many old ones.

This concept originated with the need to overcome objections to existing machinery designs, that did not always meet stringent sanitary requirements or produce the desired final end product. To improve sanitation, machines were fabricated of stainless steel and non-corrosive metals, with design for rapid and easy disassembling. Some can be knocked down, cleaned, and re-assembled within 5 min.

The more progressive manufacturers then took a seven-league stride toward integrating their units with specific needs of food processors. Complete plant- laboratories were set up with qualified engineers and technicians in charge.

In a progressive fashion this enlightened, advanced engineering concept has brought about a number of noted developments. For effective delineation, the broad classification is reduced to: (1) Comminuting or disintegrating; (2) grinding, and (3) cutting of food products.

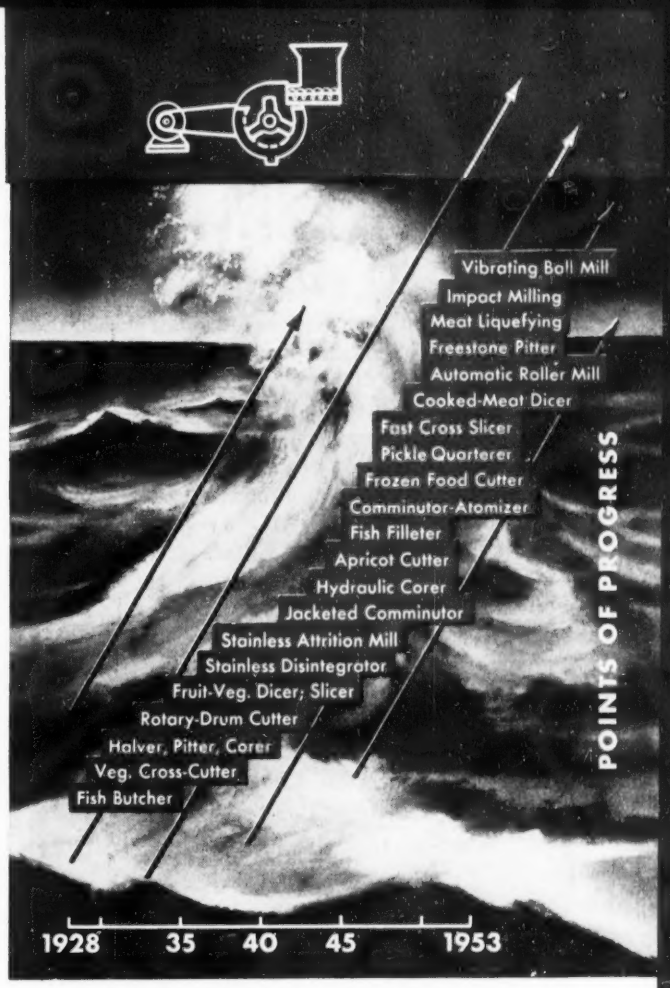
1–Comminuting-Disintegrating

The principle of comminuting-disintegrating is now recognized as including many operations in addition to simple size reduction. Some of these are: Intimate dispersion of ingredients; thorough combining of a mixture of solids and liquids; blending; smoothing; pureeing; wet or dry milling; emulsifying, etc.

Machines for accomplishing these results have, in common the mechanical principle by which they achieve comminution—employment of a rotor to which is attached fixed or swing-hammers or knives revolving at high speeds within a chamber. But here the similarity ends. For some units operate on horizontal axes, while others are vertical or set at a decided angle. Some have 360-deg. classifying screens, others 90-deg. screens, and still others depend upon mechanical or air-separation.

Engineering Progress

The wide range of the materials handled—crystalline granular, soft or fibrous—is testimony to the machine's versatility. Product sizes range from coarse to ultra-fine. Coarse particles may include those from 20-80 mesh; fine, 80-200 mesh; superfine, 200-400 mesh, ultrafine, down to 3-5 microns.



Points of progress are new developments.

First mills for food products were adaptations of those used in other industries. Records indicate that probably the first comminuted product was powdered sugar. Then, in rapid succession, all branches of the industry found uses for these machines.

An outstanding improvement in tomato processing in the early '30's occurred when a vertical disintegrator was adapted. Up to this time, tomatoes were cooked to reduce them to purees, juices, ketchups, and pastes. Use of a disintegrator instead of high temperatures, resulted in a product having much better color, a higher percent of pectins stripped from the seeds, and, if quickly preheated, higher yield. To protect the product, the grinding chamber was flooded with steam to exclude air.

The horizontal type comminutor was introduced a few years later. First unit was specially designed to reduce whole potatoes, including skins, to a finely divided crush.

As operations increased, design changes began to keep pace. With one horizontal unit, the comminuting chamber was made reversible and the rotor equipped with both impact and knife edges. This provided extreme flexibility in size-reduction, for by merely reversing the chamber—a simple, quick operation—the machine was made into an impact or cutting mill.

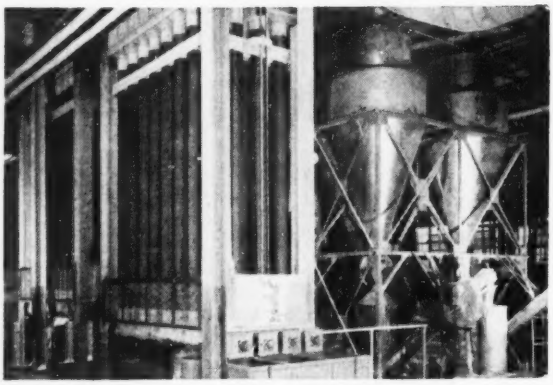
A more complete selection of blades or hammers was being offered for various products. The simple open-throat feed was changed, and automatic, helical screw-type feeders were added. By varying the drive rate of these screws, accurate feed control, so necessary with some food products, became possible.

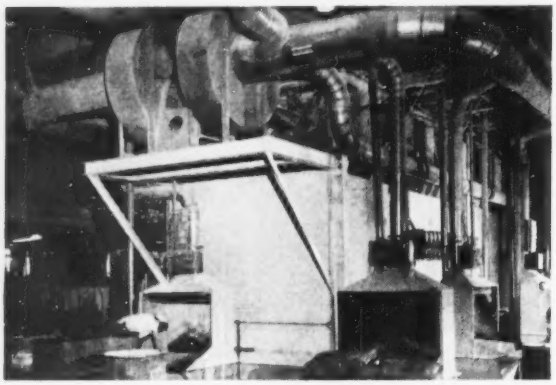
To meet some extreme conditions posed by low melting point and heat sensitive products, feed throats and entire

HOW PILLSBURY CONTROLS DUST IN CAKE MIX PLANT...

DAY engineers in collaboration with Pillsbury engineers designed, engineered and installed the compact, efficient and economical dust control systems in the Pillsbury cake mix plant at Hamilton, Ohio. Space and head-room were at a premium in this modern, one story plant and as can be seen in the photos the equipment was placed to consume a minimum amount of space.

Two unhoused DAY "AC" (reverse jet, automatic-continuous) Dust Filters (photo right) clean and return to the work space the air from one double DAY Exhauster.



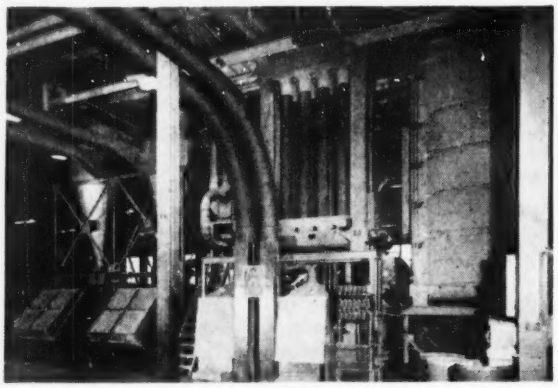


DAY "AC" Filters provide filtering efficiencies up to 99.99+%. The double DAY Exhauster (photo left) controls all of the dust from the bins, dump hoppers, mixers and other points where dust is created.

With DAY "AC" Filters all of the dust control equipment can be kept within the plant. This eliminated the need for placing equipment on the roof, resulting in a neater looking building.

Two DAY Dual-Clone Separators with rotary valves (at right in photo above) are used as primary separators on the DAY Pneumatic Conveying Systems.

A *housed* DAY "AC" Filter (photo at right) is the secondary separator for the pneumatic conveying systems. DAY Pneumatic Conveying Systems provide a self cleaning and flexible method for handling bulk materials. They can be installed where mechanical conveyors won't fit.



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rotor chambers were jacketed for chilling or heating. The air stream may also be adjusted for temperature and humidity. Provided are means for discharging a comminuted product, at almost any practicable temperature, and/or moisture level. Inert atmospheres may be provided separately or in conjunction with these specially controlled effects.

It then became possible to meter, accurately and automatically, several kinds of materials into one mill. This innovation affords a means of changing from tedious batch to continuous procedures. The roughly mixed but correctly proportioned product is fed in continuous fashion to the comminutor. This gives a uniform, thoroughly blended and mixed end-product that can be packaged immediately. And if some of the ingredients require size-reduction, selection of screen or air separation equipment and impact hammer or blade will accomplish this simultaneously.

A further innovation in this field was introduction of liquids with dry products being metered into the mill. The rotary hammer action creates a continuous spray-blending operation, maintaining formula ratios between wet and dry ingredients and producing a thoroughly mixed end-product.

Unit Operations Available

Most mill manufacturers are now prepared to offer, in addition to their machines, complete size-reduction unit operations. With products that lend themselves best to air separation, and with mills designed for only air separation, this unit-package assures efficient operation. The entire process, usually a closed circuit, consists of the mill, cyclone collector, mechanical air separator, and tubular collector. With mills in which a fan is not an integral part, air flow is provided by an additional fan.

With some mills using air classification, materials can be produced in the lower sizes (15-20 micron), with a minimum of over-size. Such products as cocoa powder and sugar lend themselves to this type of operation. Other products with smaller crystalline structure can be ground to where 95-99% is finer than 5-10 microns.

As new food products were developed, comminution engineers devised means to improve their quality or reduce processing costs. Handling, too, became an item with some frozen foods. To reduce these to usable form, pre-breakers were designed and built as integral units into existing mills. In some lines, pre-breakers and mills were installed separately in tandem style.

Here again, complete unit operations were made available—for example, a feed conveyor, pre-breaker, helical screw feed to the mill, and product exit conveyor or screw mover.

Makes Better Baby Food

Engineers next turned their attention to the large meat packers. Pediatricians and dieticians had pointed out the desirability of a comminuted-meat baby or infant food. Their requirements specified a puree of such fineness that it would pass through a nipple. These specifications were more than met. In fact, to improve processing operation efficiencies new units were designed. Among these was the angle-type disintegrator.

This unit is designed for complete and rapid removal (for sanitizing) of all working parts, screen, rotor and other parts in contact with the product. Vertical and horizontal units also offer this facility. Special quick-opening clamps permit direct access to the rotor assembly and the rotor chamber.

2—Grinding

Attrition type mills (plate, stone, stone-composition and roller mills) of today are the direct descendents of the mechanical principle of the stone mills of antiquity. However, these machines have been so refined and improved that their end-products, capacities, and efficiencies are at a level far above the performance of the mills available 25 years ago.

Within the last five years, there has been developed for grain a revolutionary mill that virtually eliminates the need for operational labor. This mill has a new, high-speed vibratory feeder powered by an air motor, providing flexibility, uniformity, and accuracy. It feeds a thin, continuous stream of grain over the entire length of the rolls, giving maximum capacity.

Roll pressure is set with adjustable, calibrated hand-wheels. Compressed air, from a single source, provides a positive means of maintaining equal pressure at both ends of rolls. A micro-switch, mounted in the inlet of the machine, activates a solenoid when flow of stock to the mill is interrupted. This is coupled to an air diaphragm that automatically spreads the rolls, preventing damage to their corrugated surfaces. When stock flow resumes, rolls automatically reset themselves and resume grinding.

Each roll is powered by an individual motor. Roll pressures are not sufficient to crush more resistant materials, such as stones or metal. These cause the rolls to open, and permit the materials to pass through without damage to surfaces. Sanitation is stressed in the design and construction. Corners are rounded, ledges and pockets are eliminated.

A brand new approach to flour milling is employment of impact instead of rolls for the first break. Used is a centrifugal machine similar to the ones for control of insect infestation. A similar principle is applied to removal of hulls from oats before processing.

A relatively new roll-type coffee mill, adaptable to multiple installation—one unit above the other—offers micrometric roll adjustment in increments of 0.002 in. while the mill is in operation. Its housings are designed to be self-cleaning, and there are no ledges or corners where coffee may accumulate.

Another mill, using special carborundum plates that operate safely at 5,400-7,400 rpm., is finding growing acceptance for grinding mustard, peanut butter, chocolate, and other products. This mill has been highly refined from an engineering standpoint, featuring stainless construction, water and air-cooling, variable but high speeds. Complete unit operations—including constant feed pump systems, etc.—are included.

Two new technics and machines, not yet fully exploited in the grinding field, presage the trend of future grain hulling and size-reduction.

"Explosive dissociation", developed in 1947, indicates that the technic of explosive release of compressed air in grain may produce a new means of hulling and flour grinding.

By varying pressures and pressure contact periods, almost any end-point can be obtained. With low pressure and short contact period, oat hulls are removed completely without harm to the oat berry. With somewhat higher

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pressure, the oat is split and the germ removed. With still higher pressures, grains can be pulverized.

The "motionless" mill, developed in 1951, also known as the "Fine Particle", or fluid-energy mill, follows the principle of fluid energy attrition. In this mill, an injector feeds material from a hopper into the reduction chamber. Pressurized fluid, air, steam, or any gas or vapor, enters the manifold and is discharged through suitable nozzles into the reduction chamber at sonic or supersonic velocities. Feed material is entrained by the stream of circulating gas. The reduction chamber is cylindrical and shaped like an irregular oval. Thus, the violent jet action tends to break up the individual particles through impact and abrasion as they speed through the chamber. Centrifugal force shifts the larger particles toward the outer periphery. Smaller particles work toward the inside of the cylinder —as they are reduced to desired sub-micron size—then escape with spent fluid through the classifier outlet into centrifugal type collectors.

3—Cutting

Most significant advance to occur in food cutting during the past quarter century is development of machines that greatly increase capacities and provide higher quality products. Prior to this time most machinery was extremely slow. This was largely due to use of reciprocating parts which, by their nature, required slow speeds. Also, this principle was not conducive to good food cutting, therefore resulting cuts were neither smooth nor uniform.

One of the most ingenious semi-automatic cutting machines is the salmon butcher-cleaner. This unit indexes fish, and a knife, shaped to make a curved cut around the nape-bone, removes the head with minimum of waste. The fish is then grasped by pincers and moves between revolving drums where, in successive operations, the tail, belly, and gill fins are removed by saws. A revolving saw-toothed knife then slits the belly, and the viscera is removed by scrapers and high-pressure water spray. The completely butchered, cleaned fish drops onto a conveyor leading to further unit operations.

A filleting machine for cod and haddock, perfected in 1943, employs a pair of cutters set on an angle to remove the dorsal fin. And a pair of plow knives makes parallel cuts along the dorsal side of the fish.

Then, special knives cut on each side of the belly fin to backbone. Ribbing knives sever the thin strips of flesh along each side of backbone and ribs to produce two fillets. Output per man-hour is doubled; yield up 6½%.

All major mechanical improvements in the halving and pitting of clingstone peaches, the largest canned fruit pack, have been developed during the last 25 years. One of the first steps was introduction of a semi-automatic peach halver-pitter. This machine made it possible for one operator to average approximately 500 lb./hr. production—more than double that possible with previous methods. It remained in widespread use until development of the rotary-type pitter. This latter unit is fed by two operators. It has a pit-finder that automatically adjusts knives to size of pit, regardless of variations. This improved machine, which will pit-halve both clingstone and freestone peaches, has a capacity of 1,200-1,400 lb./hr. and produces a very high yield of usable fruit.

The semi-automatic pear peeler-corer and halver, fed by one operator, trims, peels, cores, and halves 600-700 lb. of fruit per hr. Previously, operation was manual.

In the early '30's the combined tomato chopper-and-pump unit was developed. This machine and the previously mentioned comminutors made the "hot-break" method of processing tomatoes possible. There were labor savings resulting from this in-line mechanization, but the great value was improved quality, color, and yield.

Tomato Corer Ups Production, Yield

A machine for coring certain fruits, including tomatoes, which are to be packed whole, was developed about 1944. As compared to hand-trimming, this unit conservatively increases production 2½ times. With tomatoes, it produces a 15% higher product yield. A blade, which varies in design according to the product being trimmed or cored, is mounted on a turbine wheel that is spun by a jet of 100-200 psi. water. A rubber diaphragm cover controls depth of cut. Being water-powered it is immune to damage from water, steam, juices, and acids. Used water keeps the unit clean and washes away trimmings.

Dicing, cross-cutting, and bean snipping machines have all gone through an engineering evolution. First machines of this type made their appearance in early '30's. And today cutting units have changed the complexion of certain phases of food preparation. One example is a machine that will cut leafy vegetables into ¼-in. squares so that they are more easily handled and canned.

Slicing machines, especially those used for pickles, have been developed quite recently. These high-speed, transverse type units cut the product one slice at a time, at 500 slices per second. New units now available dice pickles into ⅛-in. cubes at capacities up to 14,000 lb./hr. Another outstanding unit slices-dices tough root vegetables. Cutting or slitting machines for cream-style or whole-kernel corn now have capacities as high as 2 tons per hour.

The pineapple sizer-corer has gone through numerous improvements. It now is automatically fed, with a capacity of around 45 pineapples a minute.

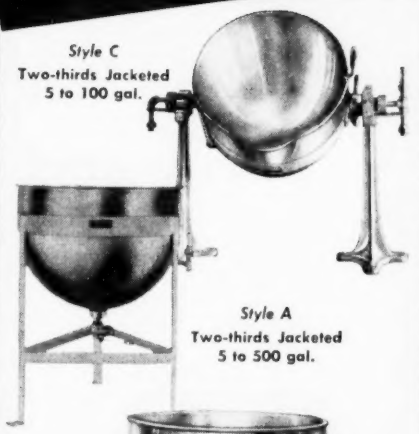
The meat chopper or grinder is now used in various other food processing fields. Broad use is made of this mechanical principle in the citrus plants, where peel is ground for oil extraction, pectin, or feed manufacture. The latest models have capacities ranging up to 5,000 lb. of ground meat an hour.

The Future

Trend for the future in size-reduction is clearly outlined. It is toward higher speed equipment that will produce greater volume, better quality foods, and new products not now available.

Future tendency in cutting operations is even now leading to higher capacity equipment that will produce more unform cuts and higher quality products. Main hurdle in future progress is to reduce the impact of knives, and other parts of machines contacting the product at high speeds, so that the food will be sliced or cut, not crushed. Higher capacities are already in sight for dicing machinery. One firm reports the development of a machine that will produce near-perfect cubes at up to 36,000 lb. an hour.

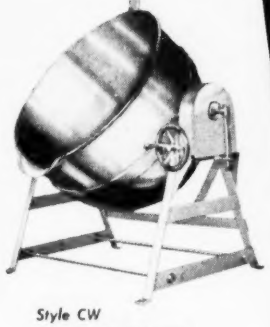
COOKING KETTLES



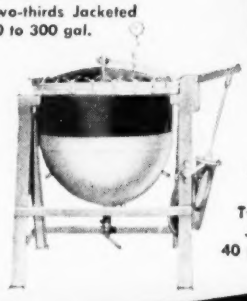
Style C
Two-thirds Jacketed
5 to 100 gal.

Style A
Two-thirds Jacketed
5 to 500 gal.

Style B
Full Jacketed
10 to 300 gal.

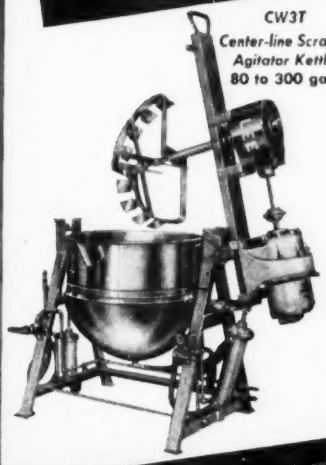


Style CW
Two-thirds Jacketed
80 to 300 gal.

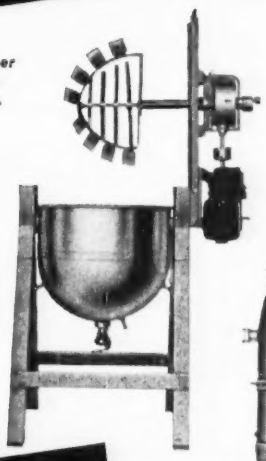


Pressure Kettle
Two-thirds Jacketed
40 to 200 gal.

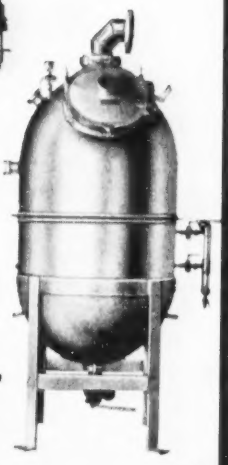
MIXING AND BLENDING UNITS



CW3T
Center-line Scraper Agitator Kettle
80 to 300 gal.



A3T
Center-line Scraper Agitator Kettle
25 to 300 gal.



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50 to
500 gal.

Quick Cooling Pan
50 to 200 gal.

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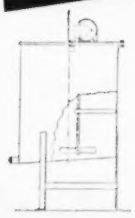
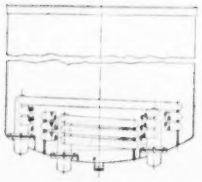
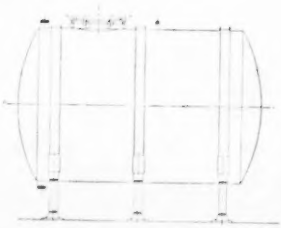


Mixing Tank
25 to 500 gal.



Pulp Tank
500 to 2,000 gal.



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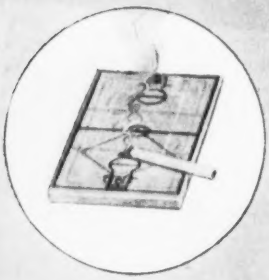

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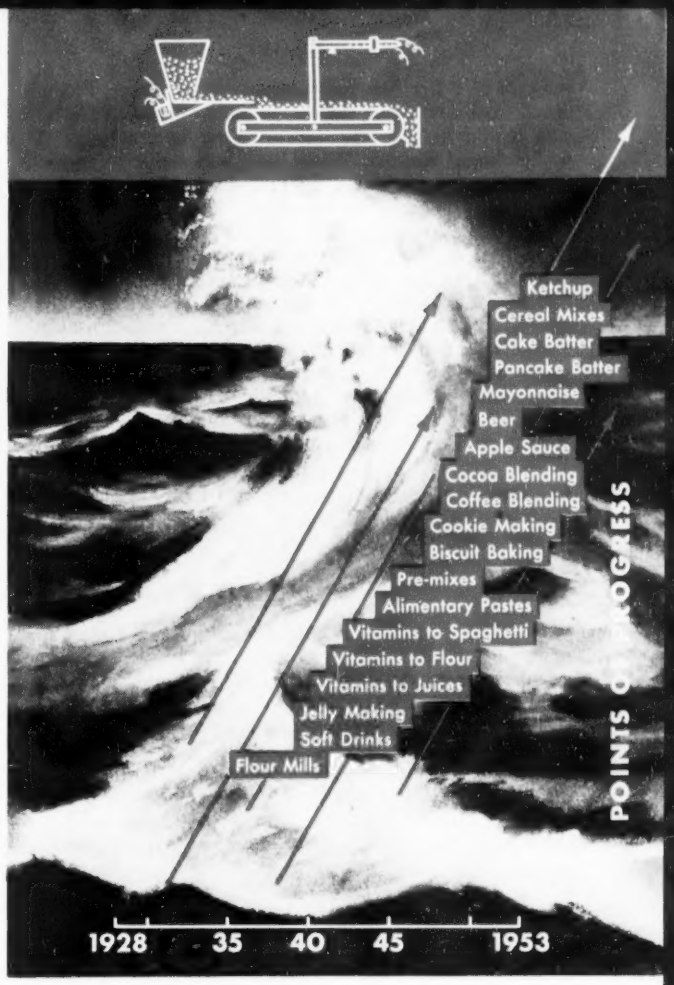

Points of progress are metering advances improving the uniformity of food mixtures.

A CONTINUOUS PROCESS represents the ultimate in modern production methods. And one of its essentials is automatic measurement and feed of the necessary components. Equipment to perform this function can save material losses due to overfeeding and can maintain close feed limits to provide product uniformity.

The positive-displacement meter has been in use for at least 30 yr. and probably represents the first piece of equipment available for automatic proportioning. But as late as 15 yr. ago, the food industry was hardly aware of it.

But progress is hard to impede, and by the late '30's effect of developments on a variety of fronts began to be felt. Manufacturers considered new methods and processes; the application of new equipment was eagerly investigated.

Vitamin fortification offered an excellent opportunity for the introduction of automatic feeding and measuring devices. Vitamins had to be supplied to the batch tank in quantities so small that normal methods for feeding and measuring could not be used; overfeed could represent a costly loss.

Two equipment manufacturers developed solids feeders of the volumetric type for this application in the early '40's. One uses a grooved plate and plow. The groove, machined to a known capacity per unit of length, emerges filled from below its supply hopper. A plow fits the groove closely and forces the material out of the groove into the discharge chute as the plate revolves past it. Changes in delivery are accomplished by adjusting plate rpm. Capacity ranges can be furnished as low as ¼ oz. per hr.

Another unit uses slow moving feed rolls to deliver a ribbon of chemical to the discharge chute. Hopper is mounted above the rolls and contains guide vanes to distribute the material across the face of the upper roll. Changes in feed are accomplished by varying the ribbon from the feed rolls passing through a graduated feed slide. In both units oscillating arms or scraper devices prevent arching, caking, or lumping of chemical in the feed hopper.

Volumetric Feeders for "Pastes"

Solids feeders such as these are now used in the production of vitamin-enriched macaroni, spaghetti, and noodles. They have also been used for adding a bleaching agent to flour. Another application opened up by vitamin fortification was addition of vitamin C to juices.

In this case the form selected was as a liquid. A positive displacement meter, long used for measuring water and low viscosity liquids, produces a rotary speed proportional to flow. This is utilized to operate a pilot valve, which in turn provides a pneumatic or hydraulic alternating flow to an impulse motor driving a positive displacement plunger pump which feeds vitamin to the juice. It requires juice flow to operate. Any fluctuations in juice flow will produce corresponding and matching fluctuations in vitamin feed. Both meter and pump are of sanitary stainless steel construction, designed for quick opening, and easy dismantling for thorough cleaning.

In 1948 the food industry applied a continuous gravimetric feeder to a blending operation. Prior to this, a simple, yet rugged gravimetric unit had been designed for feeding wheat to the first break rolls in flour mills. The new unit was self powered and employed the principle of balanced weights to maintain proper feed rate. Material falling through a variable-gate opening impinges on an impact pan and is balanced against a pre-set counterweight. Force of material on the impact pan tends to balance the beam and close the gate. As the force decreases a reverse action takes place, the pan rises, and the counterweight opens the gate. This unit is also used for measuring components to make up scratch feeds. However, accuracy available (±2%) did not provide the close tolerance needed for other applications.

The first powered gravimetric feeders designed for ±1% were used in flour mills where patent and clear streams had to be blended continuously to produce graded flours. In this case a volumetric device was unsatisfactory because the streams came in hot and then cooled to varying temperatures.

Gravimetric solids feeders that have evolved since then are basically alike but vary considerably in design. A short, endless belt is suspended from a scale and maintained at a constant weight. Material fed to the belt will maintain the balance when proper amount lies on weighed section. Any deviation in this set-weight actuates the source in such a way as to increase or decrease flow and bring it back into balance.

One manufacturer uses scale deviation to change the

position of a free hanging wedge-shaped bumper. Product is fed from a vibrating tray to the scale. The vibrating motion is imparted by a cam-operated oscillator through the wedge-shaped bumper. When beam and wedge are lowered because of insufficient weight of material on the belt, feeder tray vibration is increased. Conversely, too much weight raises beam and wedge and decreases feed. Changes in feed rate are obtained by adjusting endless belt speed.

Another design utilizes beam unbalance to actuate a clutch that positions a cam to raise or lower a gate feeding material to the belt. Here, the manufacturer also furnishes a unit in which the beam unbalance changes the rotary speed of a pair of spiral rods feeding material to the weigh belt. Still a third type uses the belt unbalance to increase or decrease action of a vibrator actuating a tray feeding material from the storage hopper.

For Other Processes, Too

The gravimetric feeder for solids has become an extremely popular unit for continuously handling food ingredients. Another one of the early processes in which this feeder played an important part was the continuous production of macaroni. The unit proportions farinaceous material to a mixer and also paces a control valve metering water to the mixer. Blend then flows continuously through a kneader, extruder, and onto drying racks.

In the late '40's this same principle was applied to continuous noodle production. Here, egg yolk is manually added to a mix tank to which water is fed by means of a positive-displacement meter with automatic cut-off. An operator electrically energizes the meter. After mixing, a centrifugal pump draws the mixture through a strainer to an egg storage tank. Enough storage is provided for several hours' run. Mixture is pumped to a reservoir, with an overflow returning excess to storage. This provides a constant head of egg yolk mix for continuous flow through a regulated orifice to the dough mixer. Flour is fed from a gravimetric feeder directly to the mixer. Rates of flour feed and egg-water mix are set manually, and the ingredients are thoroughly blended and fed on through to sheeting rollers, then to the cutter.

In 1942 there was installed a complex system that represented a real stride toward continuous processing. There were almost 100 gravimetric units for feeding as many different ingredients. No blend requires all 100 ingredients.

Runs are of considerable length, and the operator sets the rate for each feeder required on that particular run. Timers are used to control duration of run. And in addition, a sequencing arrangement is used. This starts the feeder farthest from the blending point. When its feed reaches the discharge point of the next feeder, that one starts, and so on down the line. Stopping occurs in a reverse direction.

In 1945 a mill turning out self-rising flour was converted to continuous operation. Here, four gravimetric feeders measure flour, soda, phosphate, and salt onto a conveyor belt. Feeders operate from motors electrically interlocked so that they will keep in step. From mixing, flour goes to hoppers supplying fillers. This conversion enabled the mill to produce and pack in 8 hr. the output previously requiring 24 hr.

Still another early-1940 continuous-proportioning application was in the blending of rice. Gravimetric units are used to feed and meter various grades at adjustable rates.

About 1945 a continuous process was developed for manufacture of pancake, cake, and gingerbread ready-mixes. In one installation, 16 gravimetric feeders are available for proportioning any of 16 ingredients. The operator selects those components he requires for his specific blend. Once set up, these blends run for two or three days before a change in formulation is made.

With discharge of each gravimetric feeder equipped with a swing gate, feed can be diverted to one of two conveyors thereby providing two blends at once, assuming of course, that no one ingredient will be required in both blends at the same time. Provided for each feeder is an individual panel equipped with a handwheel, to set required percentage of capacity, and a recorder to make a continuous chart record of material fed. Indicator lights show which panels are operating and whether they are on control. If any feed goes off control, this will, after a time delay, stop all feeders until the trouble is cleared.

Another application is the continuous production of a dry turkey and chicken stuffing in which two gravimetric feeders are used. One unit supplies finely ground dry bread while the other feeds pre-mixed spices.

A coffee producer uses gravimetric feeders to meter his various grades of beans to produce desired blends. The same type of feeder is used in a chocolate plant to govern the flow of cocoa beans to the roster to produce a smooth, continuous flow. A cookie manufacturer has developed a continuous-flow process in which a common jackshaft drives five feeders. One, a gravimetric, feeds flour; three volumetric disk units add cocoa, sugar, and powdered milk, and a positive-displacement pump meters liquid ingredients. Operator can speed up or slow down entire feed rate by changing input speed to the jackshaft, which controls all feeder rates.

Approach to Ingredient Variations

Thus far, the discussion has concerned continuous feeding and measuring, but at a constant rate. What of the product dependent on variations in one of the ingredients? Such variation could be flow, color, viscosity, temperature, pH, etc. For this, a process system is required which must be responsive to the variable.

The previously discussed liquid vitamin system offers one example: Fluctuating juice flow keeping vitamin injection proportional throughout the entire flow range. In the case of a solids feeder as the primary control source, the gravimetric unit can be used as a meter. Instead of using deviations of the scale balance to adjust feed rate, the deviations can reposition an air controller operating on the "flapper and nozzle" principle to pace secondary feeders in proportion to variable flow through the gravimeter.

In 1951, an equipment manufacturer introduced a continuous blending package for mayonnaise production. The process is part continuous, part batch. Eggs and other ingredients, plus a vinegar-water solution, are preblended and stored in stainless steel supply tanks. All ingredients except a large percent of the vinegar-water mix are fed, by means of a fixed-rate rotary pump, directly to a continuous disk blender. From here material goes to a high shear mixer, where vinegar-water is added through a flow regulator operating by means of a fixed differential across an orifice controlling a flow valve. Just before the

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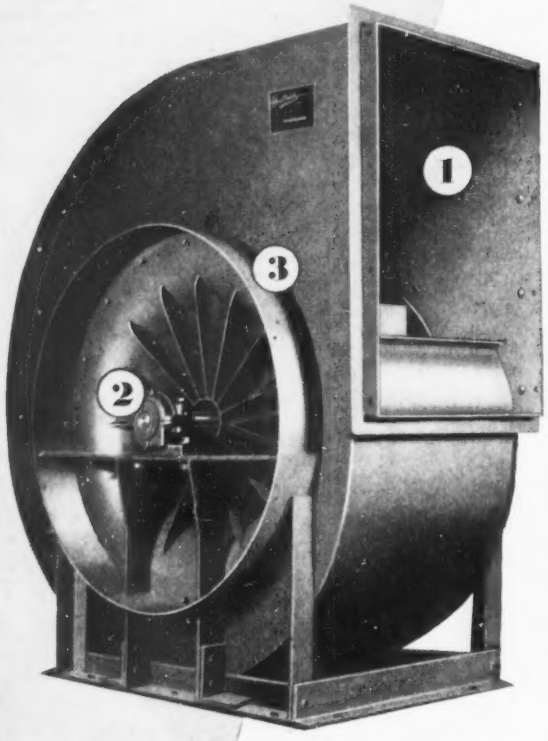

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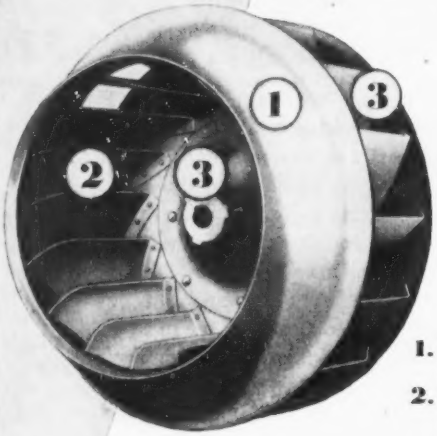

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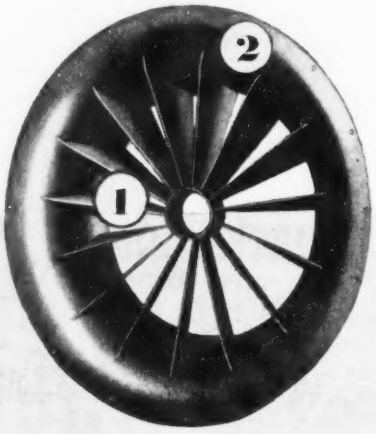

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product leaves the mixer head, nitrogen and a small quantity of vinegar-water is added to produce a uniform, high quality mayonnaise. Both feed rates can be adjusted for varying output requirements.

Shortly after development of this process, it was found that essentially the same equipment could be used to produce a high quality waffle and pancake batter, a doughnut batter, cereal mixes for prepared baby foods, and cake batter.

The cake batter process enables the baker to replace his preliminary batch-beating operation, as well as the batch blending, with a continuous process. In this system, water-soluble ingredients are pre-blended in two tanks—these enabling the operator to make up one blend while the other feeds to process. Water is metered in while other ingredients are added by the operator. (Since tank capacity is sufficient for a 4-8 hr. run, it is economical to have the operator handle this as a batch.) From this tank, a rotary pump meters the blend at a constant rate to a disk pre-blender into which flour is measured at a constant rate by means of gravimetric solids feeder. From the pre-blend tank, a second metering pump feeds the mixed ingredients to the continuous mixer. Air is added through a flow meter of the rotameter type, and the result is a light, fluffy batter.

Not only can a wide variety of cakes be turned out—sponge, cup, pound, layer, angel food—but greater yields result. The cubes also have considerably less moisture loss and better keeping quality.

This article was written by LAWRENCE LOWY, specially for the Anniversary Issue, at the request of the Editors. The author is Sales Engineer, Builders-Providence, Inc., Providence, R. I.

What Does the Future Hold?

The processes already described are an indication of the broad applications of continuous proportioning. Many more could be mentioned. And additional ones are in process of development now.

But what does the future hold? Will there be even more radical developments along the way—to relegate the equipment just described to the Model "T" category?

It seems fairly evident that in the not too distant future a number of processes will be completely continuous and automatic. By this we mean that raw materials will be delivered to storage hoppers at the plant. From this point to the package, ingredients will be handled continuously and completely by automatic equipment.

One of the delays in arriving at this stage has been the lack of an inexpensive solids flow meter. Of course, liquid flow metering is an old story, equipment being available for this for many years. Solids metering on the other hand, although available in the form of gravimetric feeders, has been far too costly to consider as an installation for each solid ingredient flow line. Yet the continuous process plant requires that all flows be monitored and the rates transmitted to a central instrument station where the operator can tell exactly what is going on in each part of his process and effect intelligent and overall control.

A device is now available for such metering of solids. It consists of a rotating disk against which the moving solids stream impinges. The disk is motor-driven and the entire unit so mounted in bearings that it freely moves about the motor-shaft axis. Load on the disk creates a reactive torque on motor housing which is directly proportional to material flow. This torque is pneumatically measured, and the output can produce a chart record and integrate or pace secondary feeders.

This type of unit is relatively inexpensive in comparison to a gravimetric weigh belt meter, and the manufacturer guarantees accuracies of ±1%, assuming, of course, that materials are free-flowing. Such a device can be economically justified as a monitor or recorder at all control points throughout the system. It will enable the central control station to receive solid flow rates as well as liquid flows and, therefore, provide a complete picture from one vantage point.

Another development that has possible application to large production demands is the continuous blender. It has been extremely effective in the metering and blending of lube oils, gasolines, and soap detergents.

It could prove most effective in the proportioning and blending of food products.

Essentially, it consists of a master control panel into which overall output rate is set. And there are sufficient component panels to provide for the maximum number of ingredients in any formulation. Thus, if a manufacturer produces many products and the most involved requires four ingredients, he would need four component panels in such a system. Master-panel drive delivers an output speed proportional to rate setting to each component panel.

Each of these panels, in turn, is set for the particular component-to-total blend ratio. Thus, a proportional speed is delivered to each component panel in accordance with the handwheel ratio setting. Individual component input speeds are then delivered to computers that compare these signals to those coming from the feed devices, be they for liquids or solids. If the feeder capacity does not match that called for from the master and component panels, corrective action is applied automatically to bring the particular feed back into balance.

The system is unitized so that additional component panels can be added as required at little additional cost. It provides a continuous operation, with blending and mixing considerably reduced because all quantities, in correct proportions, are being added at the same time. The unit represents a true control system because individual feed rate is continually fed back to the computer, which in turn compares it and takes corrective action.

Another trend that will certainly require continuous gravimetric feeders is the bakers' growing use of pre-mixes made at the mill. Each baker can have his particular formula pre-blended and mixed as a solid. Delivered in bulk to his plant, the materials need only be mixed with water in his blending device and then sent on to his ovens. A single gravimetric feeder and water regulator will neatly perform this job. Savings in labor, equipment, and time are obvious.

It is evident that the continuous metering-feeding is definitely effective in producing manufacturing economies. Not only that, but it results in a finer quality product with run after run exactly alike.

Tying such equipment into a continuous process has likewise proved effective.

All in all, with the equipment now available, continuous, automatic processing has certainly arrived. And it is bound to work wonderful changes in the food industry.

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Grand opening at the new Shur-Good bakery meant a parade headed by two new White 3015's telling Cincinnatians that Shur-Good sells the stars!

This White 3015 has 129-inch wheelbase, 400-B transmission, 14-ft. body with 8.25 x 20 tires.

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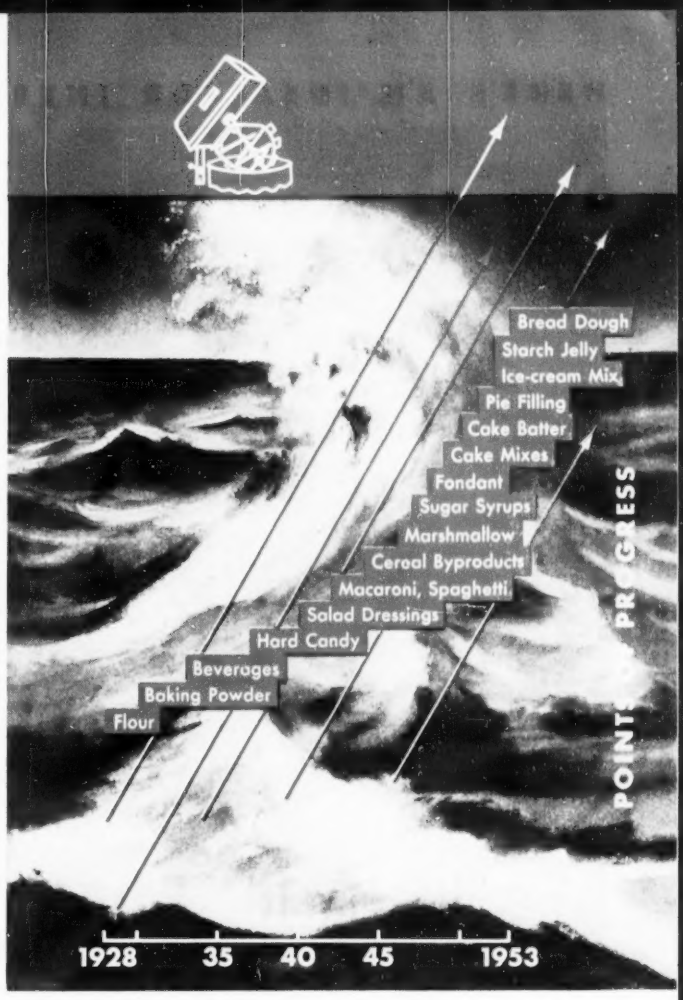
MIXING



Points of progress: New applications of continuous mixing.

ENORMOUS PROGRESS has been made in mixing methods, processes, and equipment since '28. This advance has not followed a uniform path by products—nor taken an even upswing relative to the time in years. It is best illustrated by the accompanying wave chart, showing slow advances up to 1945, then a sudden upsurge which still is in force.

There had been an earlier notable rise in the '20's. Then, new flour types were developed and the present American white loaf was created. Also, development of faster transportation in that decade made greater distribution possible.

Before '25, bread dough mixers were of the slow, single-speed, horizontal types. They were not capable of handling the new flours developed to obtain bread of high volume per pound. These early mixers did not have refrigerated or stainless steel bowls. Little attention was paid to sanitary designs. And the noise they made was terrific. The vertical cake mixers of the early '20's were of fixed or few beater variations having small capacities. And they were very difficult to keep clean—a "must" in today's operations.

Mayonnaise was not made by machine to any great extent prior to 1924, although some producers had designed and built small bucket type machines of their own.

Mixers for other food products would present a similar picture at that time. But it should be made very clear that the lack of progress was more bound up with such factors as technology and consumer acceptance of machine-made goods than with matters of machine design.

Regulation of raw materials was very limited. Generally, quality control was by rule-of-thumb. One of the few instruments available to the operator was a thermometer. Also, mixing equipment was often placed in poorly ventilated rooms.

Low consumer demand for machine made goods (because of inconsistent quality and poor shelflife) also had a retarding effect on developments.

Enter High-Speed Units

One of the outstanding bread dough mixer developments was the high-speed machine. It began to come into use in the late '20's. Here, the beater speed was doubled, making it possible, with the new flour, to obtain a greater volume per pound and also to mix in a shorter time.

For instance, the beater speeds of the '20's ranged from 15 to 20 rpm. The newest types today can operate at velocities up to 80.

As speeds went up, mixing time required went down. In the '20's, approximately 12 min. was required to mix a sponge dough. Today's machines do the job in 4 min.

Most of the mixer drives used prior to 1924 consisted of single-speed electric motors located openly in back and below the mixing bowls. The mixing arms were driven through an arrangement of heavy chains and straight spur gears, with little or no provisions made for lubrication, which resulted in rapid wear, noisy operation, and high power consumption. Further, operation usually was via a single wall switch without any safety control. Today's drives consist of two-speed electric motors connected to and driving the beater arms through enclosed gear boxes using herringbone gears running in oil, thus reducing both the noise and the power consumed.

Present controls are automatic, with inclusion of a timer for the two-speed motor. This timer allows the operator to determine how many minutes he wants the mixer to operate at low and at high speed, and it stops the machine when the sum of the two reaches the desired count. These controls are connected to a safety switch so that the beater stops automatically when the bowl is opened for discharge purpose.

The dough mixer of the early 20's was very difficult to keep clean, both externally and internally. No consideration was given by the designer to smooth, easy-to-clean exteriors. Moreover, stainless steel was not available. A small, often home-made, water jacket was used to keep the lower part of the bowl cooled.

Net result was that all types of ingredients collected on the frame projections and around the exposed screws, creating an intolerable sanitary condition. Fact that the inside of the bowl rusted easily added to the problem, although a more serious defect was the combined bearing and stuffing box. This assembly could not be removed for cleaning. Dough would be forced through a leaky stuffing box into the bearings, ferment, and so create an unhealthy condition as well as a bad odor.

Present-day mixers are streamlined and easy to keep clean. Stuffing boxes are designed separate from the bearing for quick inspection and cleaning. The bearing

HERE'S AN IDEA FOR INTER-PLANT HANDLING...

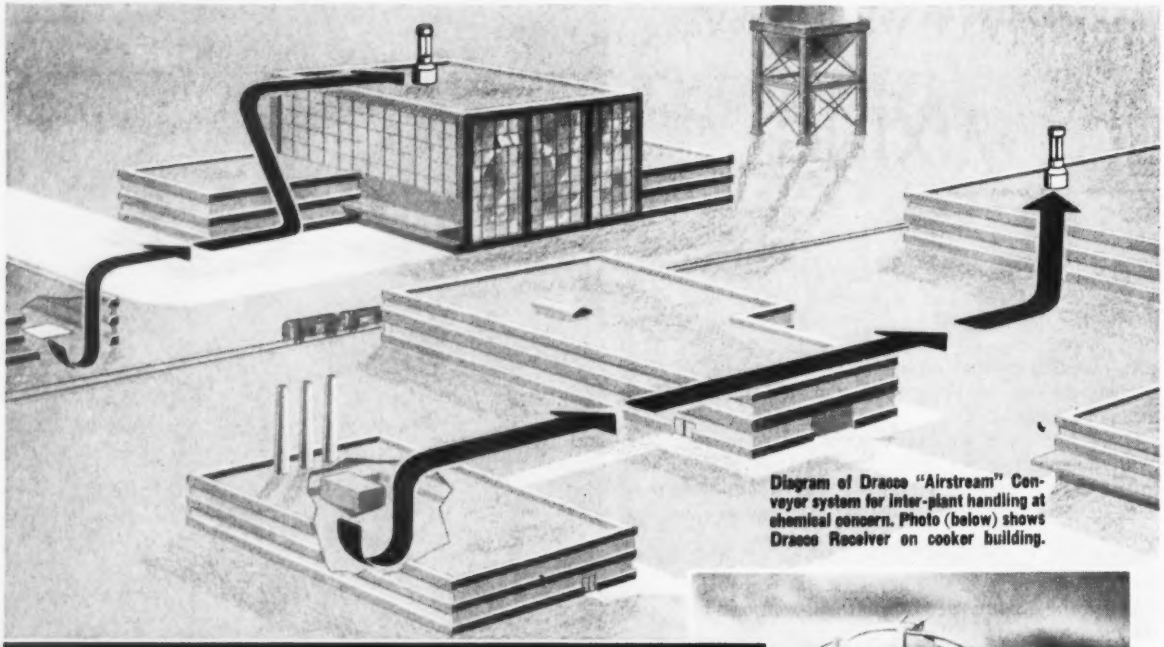
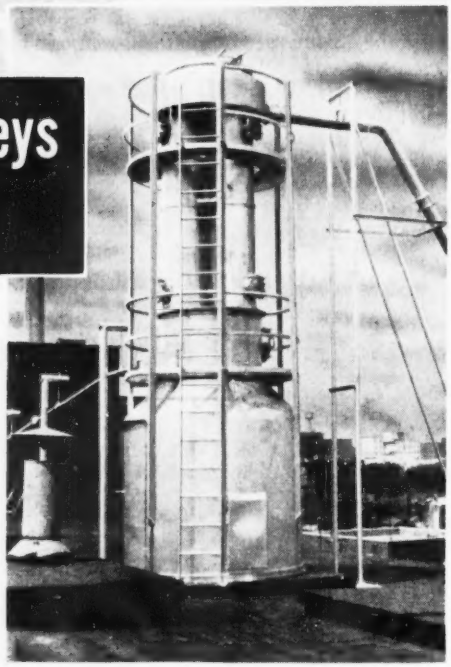


Diagram of Dracco "Airstream" Conveyor system for inter-plant handling at chemical concern. Photo (below) shows Dracco Receiver on cooker building.

Fast, Flexible *Airstream* Conveys Bulk Materials Efficiently



● Bulk granular materials can be transported *between* plants better, faster and at less cost with automatic Dracco "Airstream" Conveyors.

Dracco "Airstream" systems are profit-engineered and produce major dollar savings in labor, materials and over-all plant efficiency. Height, distance and existing facilities present no obstacle to this modern, high-speed technique.

The "Airstream" system recently installed at an Illinois plant producing biochemical feed supplements illustrates the advantages of this method. Two positive-action conveyors perform two distinct handling functions:

(1) Granular raw materials are conveyed 250 feet from warehouse to cooker building for fermentation.

(2) Dried, ground antibiotic feed supplements are moved 700 feet from feed plant to blending building.

The result is inter-plant handling that is sanitary, and economical.

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is located a safe distance from the bowl, and so prevents the dough from entering it. This construction is now demanded by most health departments.

Bowls are now cooled by various types of refrigerated jackets designed into and as part of the bowl, and special dial thermometers control the flow of the refrigerants and the dough temperature.

Material used for the bowls and other parts coming in contact with the dough is stainless steel. A new high in sanitation has thus been reached.

The reduction in mixing time is difficult to take advantage of because the machines cannot, under present circumstances, be run continuously but must be timed with the intermittent operation of the ovens. However, when baking non-stop becomes feasible, less than half the number of mixing machines will be needed as compared to the '20's.

The new accomplishments in mixing could only be achieved because improvements in the materials, flour blending at the mills, and temperature and other control developments took place during the same period. Bakers saw the beginning and the end, in general, of twisted bread, a make-up method used to increase the volume per pound and assure uniform cell structure giving the bread the soft texture demanded by the public.

Now, when it appears that the ultimate has been reached, along comes the new—continuous mixing. Involved is a process which, at least in its present pilot stage, promises a better loaf of bread more consistently than before.

Detailed information on the new process and associated equipment has not been released. However, at the present time, a half-dozen shop-test installations are in various parts of the country to gather factual data.

Facts generally known and readily understood about the new process and equipment reveal that finished mixed dough will flow from the unit in a steady stream into automatic extruding-measuring-panning machinery. Thus, there is a revolutionary difference from the present conventional batch mixers, where each of the above steps are separate and requires a number of different pieces of equipment, such as mixer units, individual fermentation troughs, dividers, rounders.

Not so generally known is the fact that fermentation takes place *prior* to dough mixing in the continuous process, as contrasted with the conventional batch-mixing operation, where it occurs afterward. There is also a marked difference in the finished consistency of the dough itself. A dough made on the old "straight" principle of the '20's is stiff and dry. Dough produced by the 1953 continuous process is soft, wet, and semifluid in comparison. Let us now consider the basic difference in procedure:

In the continuous process, all the ingredients used for fermentation purposes are blended into a pumpable yeast-broth slurry in storage tanks approximately 4 hr. before the dough mixing takes place. This time allows the yeast to react with the other ingredients for flavoring, aeration, and other purposes. The process is continuous from this point, provided that the slurry make-up stays 4 hr. ahead of the dough mixing at all times.

Slurry is now fed into a premix chamber, where it is blended into a dough mass with all the other ingredients, such as powdered milk, sugar, salt, shortening, flour. Each item is metered-in by a separate feeder, both liquid and dry as the case may be. This dough mass is then metered through the final mixing chamber, from where it is extruded, divided, and automatically placed in pans for proofing and baking. The entire trip through the blending and mixing chambers takes only 2 min. as against 10 to 20 min. in the batch process. Capacities, in lb. per hr. can be adjusted to suit each installation or bakery.

These first continuous mixers are reported to operate at approximately 4,000 to 6,000 lb. per hr. Here, too, for the present, capacity is controlled by the ovens, and the leveling off point in lb. per hr. per unit may well reach twice that figure in the future.

Expected benefits from the new bread mixing development are:

1. Lower production cost per loaf.
2. Greater volume per lb.
3. More uniform cell structure.
4. A higher degree of softness.
5. Improvement in flavor and keeping quality.
6. Unlimited production per machine unit.
7. Better quality control.

Progress Faster in Cake Mixers

The improvements in cake mixing machines were much more rapid. The change from horizontal to vertical types resulted in general public acceptance of machine-made cakes. Improvements started with the variable-speed belt-driven units over existing multi-speed gear shift units of similar capacities up to 120 qt. and the same planetary beater drive.

This development was followed in 1934 by the design of a 340-qt.-capacity machine with automatic bowl lift, speed changer and electric timer.

Several special beaters were designed for this large machine, such as the four-wing rubber edge beater. Here, the rubber edges scraped the ingredients off the sides of the bowl and provided quick and efficient incorporation of the ingredients in a minimum of time, thus making the cake business more attractive to the baker as an investment and giving to the public an improved cake product.

A special two-wing cookie hook was also developed for this machine, both with and without rubber edge, to be used for cookie doughs of various consistencies.

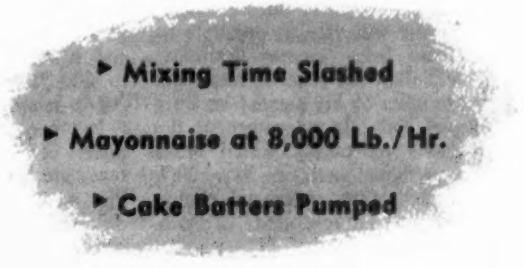
Precession Beater Drive

In 1946, the precession ratio beater drive was developed. It made possible control of the physical behavior of the material, while it was being mixed, relative to its final mass consistency. Thus, the mass motion best suited for the particular products—heavy cake batter or a light angel food mix—can be selected by the mere flip of a lever. Still retaining variable speed and automatic batch timing controls this development reduced mixing time and increased cake quality.

Basic principle of this mixer is as follows:

The precession ratio is the number of turns a beater makes around its own axis while it makes one complete trip around the bowl. Standard ratio is about 1 to 4, and this is best suited for pound cake and similar products having a putty-like consistency. It was not satisfactory for "liquid" batches because it created too much swirling and increased the mixing time as well as created an undesirable amount of heat in the batch.

Experimentation showed that all rotating movements



stopped when this ratio was reduced to about 1 to 1 and changed automatically to a vertical hand whipping action desired for products like, whipped cream, meringue, angel food.

Therefore, mixer designs with a 1-to-10 precession ratio were made for special work and a dual ratio of 1 to 2 and 1 to 4 for regular cake products.

Continuous Cake Mixers

This precession-unit development was completed around 1946 just about the time continuous cake mixers began to appear on the market. The continuous unit was quite different from the existing vertical cake mixers. Whereas the latter employed a rotating multi-arm beater along a planetary motion pattern in a bowl for a predetermined number of minutes, the new unit used high-speed, toothed-rotors working with stators in a small (2 to 5 qt.) closed chamber under controllable conditions.

The mixing chamber is approximately 14 in. dia., 2 in. deep. It has two identical heads, comprising front and back stators. An ingredient pump and a compressed-air inlet into the ingredient stream are integral parts of the machine preceding the mixing chamber.

The term "continuous mixers" is used because the cake batter is generally pumped through these units in a non-stop stream from a slurry tank or premixer. The premixer may be a tank with a propeller mixer in it, or a vertical mixer which blends these ingredients into a pumpable mass and discharges it batchwise into a holding tank of sufficient size to accommodate the operating demand of the continuous mixer.

A few completely continuously operating units have been made with automatic proportioning dry and wet feeders, feeding into a disk blender, from where the material is continuously pumped through the mixing head.

This disk blender is a completely new auxiliary equipment developed for this purpose.

Simply consisting of a 40-qt. standard round bottom mixing bowl with 3 in. sanitary bottom outlet, the unit is mounted on a tripod stand. The impeller is directly connected to a 7½-hp. motor, and driven at 875 rpm. The two truncated cones of the impeller develop in the material two doughnut-shaped rings, one on top of the other in the bowl. The slurry enters at top and the emulsion is withdrawn from bottom outlet. A 1-to-2 in. height variation of the top doughnut is controlled by a hydroplane-type level that rides on it and operates a bypass on the slurry in-take.

Among the numerous benefits gained from continuous mixing of cake batters are the following:

1–The product is consistently more uniform.

2–Volume is approximately 10% greater.

3–Changes in formulas that constitute a monetary saving and still maintain high quality products are feasible. Continuous mixers reduce particle clusters to a point far below that possible with regular mixers. They distribute the ingredients, such as eggs, leavening agents, flavors, and shortening, much more extensively than heretofore possible and produce a mass of homogeniously suspended materials that constitute good cake batter.

4–Material is automatically screened as it passes from the holding tank, through sanitary pumps, and proceeds to the mixing heads proper.

5–Automatic discharge or pumping of batters to the point of scaling eliminates the usual hard labor connected with the transfer of heavy materials, also the dangers of accidents.

6–Complete, automatic mechanical control of actions ups product quality. These tasks were formerly entrusted to machine operators some of whom were not always consistently careful in their job and hence at times delivered batters that varied in quality.

7–Higher temperature batters maintaining high cake quality are possible.

As used in the confectionery and dairy fields, a number of mixing machines are in effect bi-functional. In many cases they are tied in with heat exchangers of one type or another, not generally classified as mixers.

One of these units has been applied to many varied food items. It is now commonly used for plasticising fats, margarine, ice cream, and for marshmallow mixing. With physical appearance differing from some of the other similar functioning units, it consists mainly of a 5-in. dia. 4 ft. long jacketed tube with a toothed rotor revolving inside. It has two end pieces. The material to be treated is pumped through under controlled pressure and temperature conditions, as demanded by the product in question.

Major improvements in this field have centered more

(*Turn to page 245*)

What's Ahead in Mixing

The present-day bread dough mixer producing individual batches ranging from 100 to 2,000 lb. per hr. will gradually be replaced, during the next ten years, by continuous mixers of one form or another.

Today, there is only one type of continuous bread mixing and processing equipment on the market. Before the end of 1954 there will be several. These units will vary in principle to afford the baker greater flexibility. This will allow the baker to retain the characteristics of his present varieties of loaves and take advantage of the continuous processing, which offers lower operating cost per lb., 100% sanitary operation, automatic quality controls, and improvements in material handling.

There is no doubt this will lead to pushbutton processing that will give a tremendous economic advantage to operators, not only in new plants but also in some existing ones.

This basic change in mixing may make possible the baking of bread in a continuous strip, which then can be sliced and packaged continuously. Today, in the production of pretzel sticks, the dough is extruded, treated and baked in a continuous strip up to 600 ft. long, then automatically cut to length for packaging.

Improvements in mechanical cake mixers of both batch and continuous types are not visible on the horizon, but adaption of the high pressure diffusion principle is within the possibilities, as well as ultrasonics.

Greater improvements are in sight for marshmallow making, where diffusion units are being accepted, eliminating existing mechanical agitation equipment.

Fundamental research on mixer-engineering underway in laboratories may be expected to refine the design of many types of units and to improve performance. Much is being learned about the effect of different blade size, shape, spacing, and speed.

And ultrasonic mixing, blending, and homogenizing looks most promising. Conceivably, very intimate mixing of ingredients proportioned together in continuous flow through pipes could be effected ultrasonically —with many production and quality advantages.

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FORMING

WITH THE EXCEPTION of liquids, fruits, and vegetables, most foods must be formed. And hand-forming has, in most instances, been superseded by mechanical methods in the past 25 years. It had to be. Increased labor costs and high-speed continuous processes forced it.

Biggest strides in forming during the past quarter century have been made in depositing candies into starch or metal molds or directly upon moving belts, rolling dough into sheets to be continuously stamped out into cookies, and continuous extrusion of macaroni products.

More recently, techniques have been devised for continuous mixing and extruding of bread doughs, forming cheese slices, shaping meat and fish products, and making ice cream novelties.

Improvements in the major types of forming operations —sheeting and stamping, extruding, twisting, casting, puffing, die forming and cutting, and molding—have taken the following turns during the past quarter century:

Sheeting and Stamping: One of the most fascinating forming operations is for cookies and crackers. Cookie-forming operations back in '28 outpaced baking and resulted in the development of the continuous band oven in the early '30's.

Recently, a high-volume dough sheeter-former has been designed to stamp out almost 10,000 cookies per min.

The new machine—actually similar to the '28 model—consists of three pairs of rolls that reduce the dough to a sheet of the proper thickness. A 300-stroke-per-min. cutting head (with dies) forms and embosses cookies, with trimmings returned to the supply hopper for re-use.

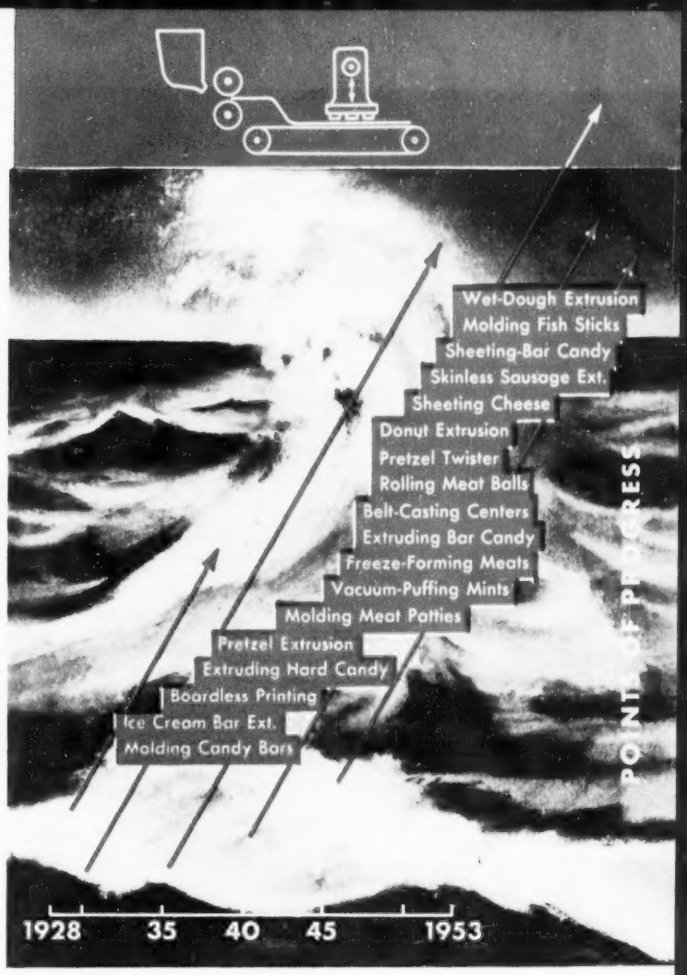
Highly mechanized is the continuous forming of 1,600 lb. of noodles hourly by a combination sheeter-cutter—a machine that made its appearance in the late '30's. Ingredients are automatically proportioned into a continuous mixer, from which the dough is fed through a series of kneaders that form it into a sheet for cutting.

New Way Simplifies Job

Here's an example of how a new process involving sheeting simplified a manufacturer's task of prepackaging sliced cheese. Instead of slicing from a loaf—common practice with this processor up until a few years ago—melted cheese is now spread over a chilled, rotating drum that cools and forms it into a ⅛-in. thick sheet at the rate of 150 lb. per min. The sheet is then cut into 3-in. ribbons by revolving knives. Ribbons are then automatically accumulated in stacks of eight, and cross-cut to produce ½-lb. lots of eight 3-in. squares, ready for packaging.

Meanwhile, the end of new bread-dough molder developments is not in sight. Conventional molders are being replaced by machines for cross-graining, and these are going through further modifications. In these units, dough passes through one set of rolls. It is flipped so as to travel in an opposite direction between a second set of rolls to overcome the objection of "wet and dry end" of the loaf. Following this are various new methods of cross-curling —either loose or tight.

Similar to the cookie-forming operation is the one for



Points of progress are new techniques and applications.

candy wafers. Employed is a machine comprising an extruder, sheeter, and cutter. Six 4-in.-dia. worm screws force candy paste through rectangular apertures to form a thick sheet, which is further reduced to wafer thickness as it passes between two pairs of sizing rolls. A double-row, reciprocating cutter then stamps out 1-in.-dia. wafers, 38 at a time.

High sheeting efficiency has recently been engineered into some nickel-bar candy lines. For instance, candy is fed from a slot-bottom hopper between a pair of brine-cooled rolls rotating toward each other. Two knife edges separate the flat sheet of cooled candy, which drops onto a moving belt. The candy hardens as it continues through a cooling tunnel, permitting overlaying of another layer of warm candy. The candy is then slit into continuous strips that are machine-cut to length. Candy bars then go to the enrober and cooler.

Production of 300 lb. of pillow-shaped mints (with or without filling) every 5 min. is the output of a combination batch forming and scoring machine—still another sheeting operation developed prior to '28 by a candy manufacturer. Candy is formed into a long roll as it passes through a batch spinner on its way to two pairs of rolls that reduce it to a sheet for scoring into uniform pieces by longitudinal and cross cutters.

Extruding and Depositing: The late '30's saw the development of a continuous method of extruding spaghetti and macaroni—an example of work simplification and elimination of non-essential manual operations. In the old way, chunks of kneaded dough were hand-loaded into one of two cylinders of a vertical, batch-type press

with a perforated bronze plate of various size dies through which the dough was extruded under 3,500 psi. Lengths of macaroni (about 6 ft.) were gathered by arm and cut off the press with a knife.

Now, a continuous operation consists of a mixer, kneader, and extruder with a die plate. Dough is extruded into shape at a rate of 1,000 lb. per hr., with one man operating three to six presses. Macaroni (long and short goods) of different shapes are formed, depending upon the type of die employed.

Many bakery products are formed by extrusion. A bar machine continuously extrudes a ribbon of dough, which is cut to length, panned, and then baked. A similar machine shapes fig bars by extruding a series of continuous ribbons of jam inside tubes of dough. Products travel through a continuous band oven and are then machine-cut to length.

Dozen-Nozzle Extrusion

Last year, a hopperless depositor—operating on the extrusion principle—made its appearance. This unit applies marshmallow or jelly on a row of cookies at the rate of 1,500 per min. It consists of a small product chamber, sliding-type valves, and a plate with a dozen ejecting nozzles. Amount of deposit can be varied—from a fraction of an ounce to several pounds—by adjusting valves on nozzles.

In making doughnuts, dough is forced, under 30–50 psi., through nozzles, each with four cutters.

Extrusion is a major part of a new, continuous dough-making process—now in the first stages of commercial application. Operations from mixing to panning take only about 2 min. Dry and liquid ingredients, including the all-important fermented broth, are fed to a premixer at predetermined rates dictated from a central control panel. Dough is then metered to a developer, from which it is extruded in ribbon form through an orifice. It is finally cut to pan size and deposited into pans.

In the late '30's, pretzel sticks were formed by continuous extrusion. Process involves extruding dough through as many as four units, each depositing 22 ropes of dough onto a stainless steel band conveyor traveling through an oven. Baked ropes are then machine-cut to form sticks.

Continuous extrusion of bubble gum was carried out about the mid-'30's. Gum is picked up from a hopper by two auger-type screws that force it, under pressure, through two cylinders and out through as many as 16 round holes in the head plate. A guillotine-type knife then cuts the ropes to length.

A similar 5,000-lb.-per-hr. unit simultaneously extrudes ten ropes of small diameter. Wrapping machines then complete the gum-forming and cutting operations. One cuts each rope to length and twist-wraps 220 pieces of gum per min. Another—a 500-per-min. caramel-type wrapper—cuts each rope and then shapes and wraps each piece.

Development by a confectioner of an hydraulically-operated extruder for making honeycomb type hard candy has eliminated the former repeated manual pulling and folding of a batch which was required to give the candy porosity. Now, a batch is loaded into a steam-jacketed cylinder, from which it is forced by an hydraulic ram through holes in a steel plate. Strands of candy leaving the extruder combine to form a honeycomb structure, which is then reduced to size as the strands pass between vertical bars. Candy is then cut to size and continuously cooled. Bar candy also is formed by extrusion, cutting, and enrobing.

Making ice cream novelties represents still another recent example of forming by extrusion. Ice cream sandwiches—3,600 per hr.—are made by depositing wafers onto a moving belt to receive a ribbon of ice cream extruded from a nozzle that is continuously fed from a Vogt freezer. Another dispenser then deposits wafers on top of the ice cream.

Chocolate-coated bars are produced at a rate of 165 per min. by feeding stiff-consistency ice cream from two continuous freezers to an oscillating depositing head. Ice cream is extruded through a die in the header, and equally spaced wires, carried on a chain, cut slices that drop onto a belt traveling through an air blast tunnel and then an enrober.

Two years ago, a skinless pork-sausage dispenser was introduced. Hooked up with a stuffer, it extrudes six skinless sausages at a time onto roll-fed paper. Pressure of the meat form the stuffer drives six pistons back to fill a similar number of parallel orifices. A reciprocating arm then moves the pistons forward to form the sausages.

Twisting: Here's an example of what utilization of automatic machines has accomplished for pretzel manufacturers faced with the problem of increasing production and reducing costs:

A specially engineered dough-twisting unit was invented to turn out 50 pretzels per min.—an operation which, up until about 5 years ago, was by hand at great cost.

This machine takes dough from a hopper by means of a worm screw which forces it into a 1-in. dia. ball that drops to the molder. Here, two molding boards, with boards moving in opposite directions, form the ball into a long, small diameter roll. Gripper fingers then twist the roll to shape and a knife cuts off excess dough.

Casting: The casting of fondants, creams, and gums in starch molds, an efficient operation in use in '28, has been improved through the years. Higher speeds have been attained by designing casting machines featuring reduced vibration and through use of multiple-row (2, 3, and 4) depositing pumps.

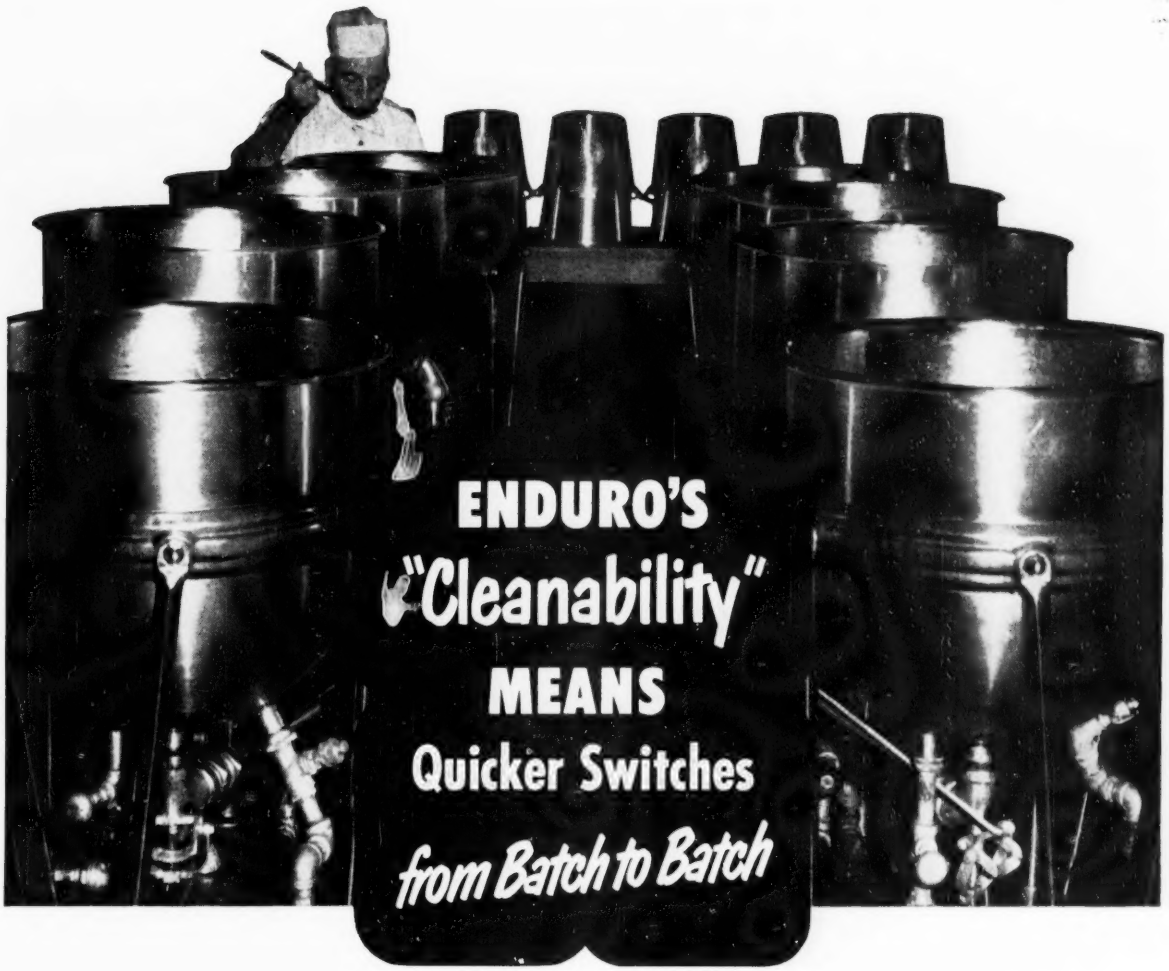
About 15 years ago, a method was devised for boardless printing and casting of fondant centers as well as cleaning the starch. A ribbon of starch is formed on a conveyor, impressions are made, and candy is deposited into each. The ribbon is automatically conditioned, and the centers are then ready for chocolate coating within 20 min. Starch is cleaned and started as a new ribbon.

7,500 Mints in 8 Hr.

Within the past 5 years, a method was devised for depositing 6,500 to 7,500 lb. of mints per 8-hr. shift directly on a rubber-belt. Immediate and rapid cooling of the mint centers prior to coating with chocolate does away with casting into starch.

Casting of chocolate bits directly onto a stainless steel band conveyor was achieved about 15 years ago on a single line with two depositors. Operation of the depositors is synchronized so that a total of 960 measured amounts of chocolate are deposited per stroke on the conveyor traveling through a cooling tunnel. At the end of the conveyor, a doctor blade scrapes off the chocolate bits.

Developed in the early '30's was the practice of casting chocolate candy bars into metal molds attached to endless chain conveyors. One firm, for example, feeds chocolate to a depositor that comprises a horizontal piston and rotary valve, so timed that the chocolate is drawn from a hopper during the suction stroke and into the piston chamber. At the discharge stroke, the valve rotates 90 deg. to permit entry of chocolate to discharge of pump. Choco-



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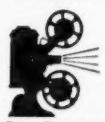

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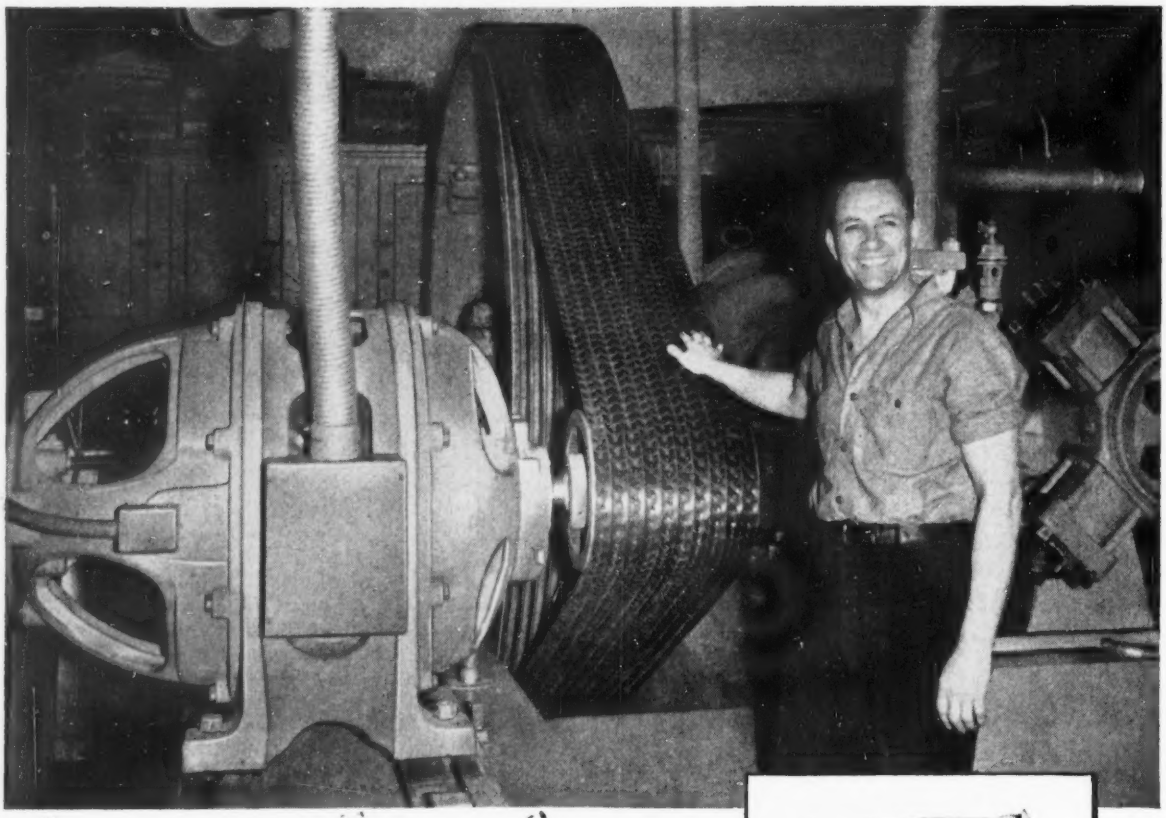

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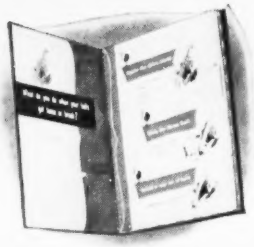

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late is then deposited with each stroke into two rows of metal molds attached to a chain belt. Molds pass over a shaking table on the way to a continuous cooler, and candy bars are then automatically dumped from molds.

Puffing: Cereals were puffed long before '28, by heating grains in a pressure chamber and releasing the pressure. Relatively new cereals like "Kix" or "Cheerios" are prepared from a cooked dough that is forced through extruding dies, cut to size by a rotating knife, dried, and exploded in a puffing gun.

About 10 years ago, a novel method was devised for expanding pillow-shaped mints to double their volume by a vacuum-cooling technique. First machine-pulled, the candy is then shaped into a tapered roll in a batch-former, snipped to size by a rotary cutter, and expanded in a long vacuum-cooling tunnel.

Speeds Hard-Candy Output

A die-forming machine which came out about 1950 produces plain or filled hard candies at a rate of 250 lb. per hr. Employed is a highly efficient line comprising an automatic machine for feeding fillings into a rope of hard candy, and thereafter to batch-former, 4-step sizer, die-forming-cutting unit, and triple tier cooler. Candy is converted into such standard shapes and sizes as pillows, balls, cushions, kisses, and barrels by means of readily interchangeable dies.

Introduced about 5 years ago, a dual sausage-stuffing system has increased production by 25%. By connecting two stuffers with a T-shaped pipe and using one man to fill these units, two operators now stuff meat into casings without interruption.

Five years ago, prefabricated, portion-control frozen meats such as steaks, hamburger patties, and beef roll appeared on the market. Hamburger meat, for example, is stuffed into a double-wall cellophane tubing. Ends of the casing are tied and the meat is frozen. After proper tempering, the roll of meat is cut by a modified bacon slicer. The slices are then packed in consumer-size units and refrozen.

During the war, hamburger patties were machine-formed for the Armed Forces. In this practice, hopper-fed meat is forced by a horizontal screw into a vertical cylinder based on a revolving plate. The plate functions as a forming mechanism and circular conveyor. The cylinder is fitted below with a cam-operated piston and piston rod. As the piston rod passes over the cam, the pattie, formed in the cylinder under the force of the screw feed, is pushed to the revolving head. Thickness of the pattie is determined by adjusting the piston in the cylinder. When the piston is in the discharge position, the pattie is removed from the top of the revolving head by a circular spatula rotating opposite to the revolving head.

About 1948, the forming of meat balls was mechanized. One unit employs a power-driven worm screw that forces the meat from a hopper through a nozzle, then into the path of a rotating wire-frame cutter. Rotations of the cutter are synchronized with the speed of the worm screw to form the extruded meat into uniform lengths. Meat drops onto a conveyor and contacts a superimposed belt that travels slightly faster and in opposite direction to the lower one to impart a forward and rolling motion.

Now to another postwar forming development: Frozen, boneless stew meats are formed in 3-lb. blocks to simplify meal preparations for the institutional trade. Meat is diced to uniform size by machine, frozen in metal molds, removed from molds, and finally cellophane-wrapped to be packed five 3-lb. blocks to a carton.

Quick Way With Fish Fillets

Within the past year, controlled-portion fish fillets (breaded or fried) have been shaped into various forms by a simple technique. Fillets are layer-packed into 2x10x20-in. cartons and frozen into a solid block, later to be cut by a band saw into 1½-oz. sticks, 2¾-oz. squares, or 4-oz. dinner portions. Pieces are then dipped in batter, machine-breaded, and re-packaged.

Back in the early '30's, triple-flavored blocks of ice cream were formed by a 3-ribbon machine. In this procedure, paper-lined aluminum trays are conveyed under a 3-section nozzle that continuously fills them with a triple-flavored ribbon of ice cream. Trays continue through a hardening room. Ice cream is then dumped from trays and cut to length by a rotating knife.

Still another ice cream-molding operation: Chocolate-covered stick novelties are made by feeding ice cream into a hopper that deposits measured quantities, 24 at a time, into metal molds. Sticks are inserted, and molds then travel through a freezing tank. A stick holder with 24 "pops" is removed from molds and hung on a conveyor traveling through a chill tunnel prior to dipping the ice cream into melted chocolate.

The Next Twenty-Five Years?

What can we hope to see in the next 25 years of forming foods?

Still faster forming is demanded by processors. This may be achieved by using better process controls to assure proper formability of the material and dimensional controls to achieve accurate shape and size. Also, automatic feeding of product to forming machines will greatly reduce manual handling time.

Sanitation will be emphasized. Machine parts will be built for quick disassembling and reassembling for cleaning operations.

Parts—dies and molds—will be coated with Teflon or silicone to prevent sticking of products and to curb machine-downtime. Temporary molds, like those employed for starch-casting of candies, will be replaced with permanent ones. Already, metal molds are used for chocolate bars, and rubber ones are employed for cherry cordials.

Improved processing techniques will be designed to eliminate an operation. For example, continuous forming of noodles directly into soup cans has abolished the drying operation and manual handlings.

Another example is the continuous dough-making process designed to eliminate sponge fermentation, floor time, dividing, rounding, overhead proofing, and molding.

Every one should closely watch what develops in all branches of the industry and borrow new ideas. Between now and 1978, much progress will be made by borrowing. It's been going on. Hard candies, for example, are being extruded through hydraulic presses in much the same manner as macaroni products. And cheese processors are stuffing cheese into casings in the same way that meat packers are stuffing sausage products.

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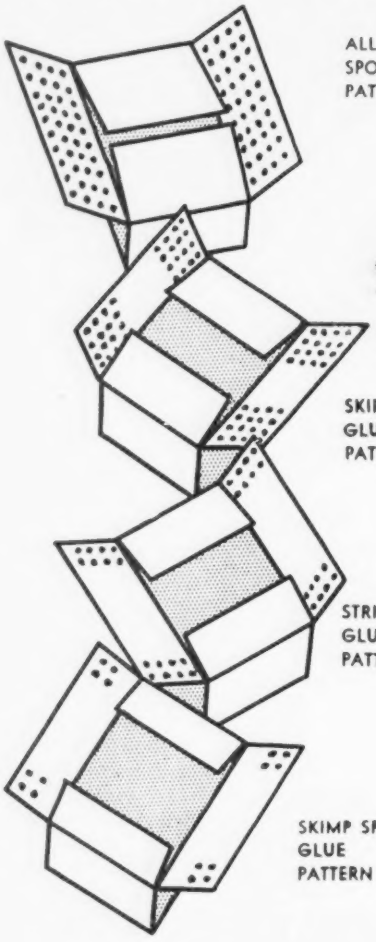

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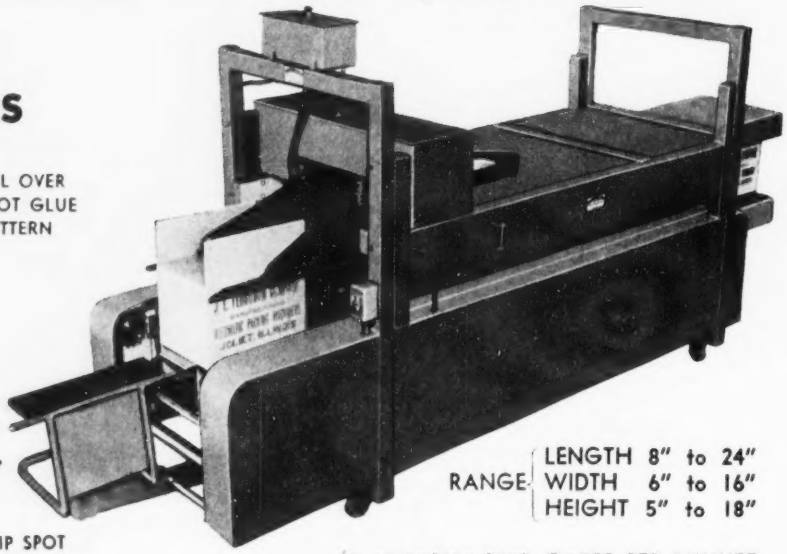

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COATING

BASICALLY, new materials, processes, and equipment were responsible for improving coating operations and increasing worker output during the past quarter century.

Coating machines, in a few instances, have been combined with other units to speed operations. For example, chocolate mints are now being produced on a high-volume basis by converting operations to continuous flow. Centers are deposited directly onto a moving belt, cooled, and chocolate-coated independently, but simultaneously.

Feeding of products onto a moving belt traveling to a coating machine has been mechanized. Take the coating of cookies with chocolate:

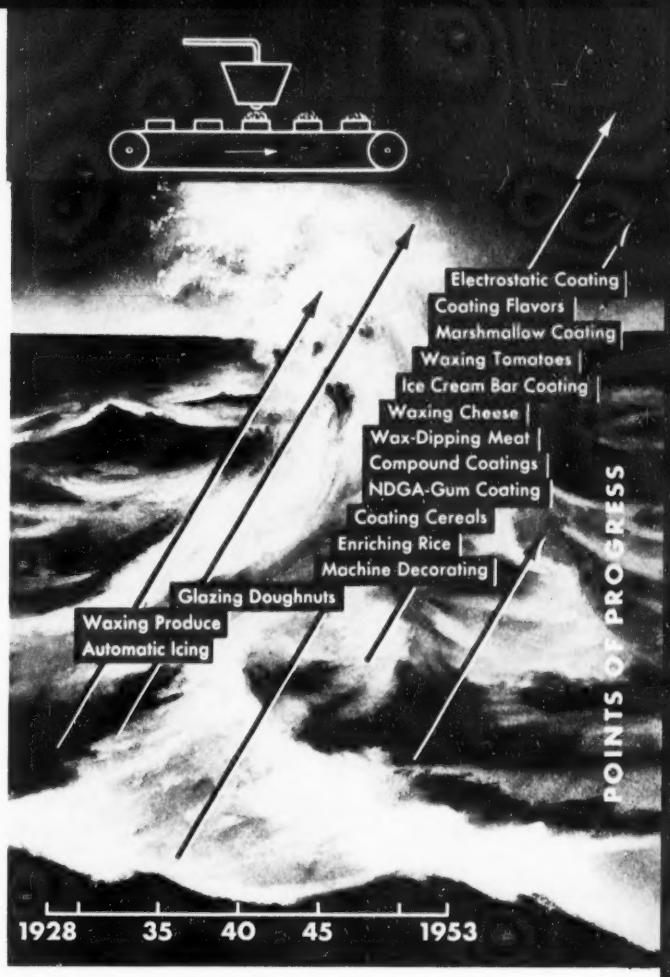
A reciprocating-type pusher-plate at the bottom of a multi-compartment magazine slides a row of cookies onto a belt going to a chocolate enrober. Formerly, arranging the cookies on the belt was performed by hand—an operation involving several girls.

Significant has been the development of a multiple-coating machine—one designed to cover a variety of flavored centers with two types of chocolate coating. This change has speeded the packing of an assortment of chocolates directly into cartons.

Emphasis on bettering coating techniques was split between improving existing methods and developing new ones.

We present here a look at some of the significant coating methods employed during the past 25 years—ending up by looking to the future.

Machines for mechanically coating candies, nuts, fruits, and cookies with chocolate made their first appearance about 40 years ago. Items were originally hand-arranged in rows on a conveyor traveling to the mechanical coater, which is more commonly known as the enrober.



Points of progress are new methods and applications.

Advanced Units Appear

More recently, candy centers have been dumped into two oscillating hoppers, each automatically spacing them in rows on a conveyor. Centers pass over a bottomer, where a thick chocolate coating picked up by a roll from a water-jacketed, thermostatically-controlled tank is applied to the bottoms. Bottomed centers continue over a refrigerated slab for rapid setting of the chocolate.

Complete chocolate coverage is accomplished by the enrobing machine, which is equipped with fans, temperature controls, and mechanical shakers that give the desired finish to the coating. Coatings set as the candies proceed through a multi-tier cooler inside an air-conditioned room (68 deg. F.).

Latest mechanical coaters are built with large blowers to remove surplus coating and with a panel for all switches and valves to simplify and speed operations. Machines have also been designed for better sanitation. For example, all parts are accessible for cleaning. Pumps and tempering-column scrapers are easy to dismantle and reassemble. Also the units have been streamlined.

Newer units have also been designed so that two kinds of chocolate coatings can be run simultaneously. Centers of many different flavors can be fed to the coating line in two groups—one being covered with milk chocolate, the other with a dark one. This arrangement enables the confectioner to pack directly from conveyor into 1- or 2-lb. cartons instead of into 5-lb. stock boxes and then from these boxes into the cartons.

Within recent years, various types of accessory equipment have also been added to enrobers for machine-decorating candies. Hand work known as "roughing" and "stroking" are expensive at today's wages, and the trend is toward eliminating it. Most common decorator consists of light moving belts, which contact candies leaving the enrober. Contact with the belts produces a design on top of coated piece and roughs up surface.

Ice cream novelties, with or without sticks, have been chocolate-coated prior to '28. Now employed is a rotating mechanism with as many as 16 arms, on each of which is mounted three dipping tongs. Arms automatically lower so tongs grip sticks of defrosted ice cream bars, then lift them from molding pockets of a freezing table. As arms continue to rotate, they lower to dip bars into melted coating, then raise to drain excess chocolate into a holding tank. Tongs release bars for automatic bagging.

About a year ago, a continuous method was devised for making chocolate-coated ice cream bars. Ice cream is extruded into a continuous, thick ribbon, hardened, and cut into bar-length. Bars are coated (165 per min.) by a bottomer and enrober.

Within the past 5 years, compound coatings increasingly have been used for candies and cookies to resist summertime deterioration. These coatings are handled by en-

robers and, for the most part, consist of hard vegetable fats, sugar, and milk. Chocolate liquor, cocoa powder, or both, are often used. What's more, these coatings can be attractively colored and flavored to make eye-appealing assortments.

Also, 1950 saw the first successful belt-line technique for wax-coating cheese. Developed was a new wax-coating machine—an off-shoot of the continuous chocolate enrober—that now turns out three times the old-volume peak set by four hand-dippers. Latest is the use of this machine for wax-coating pickles.

Wax Coaters Cited

The early postwar years saw the appearance of a wax dip-coating technique for frozen products like meats, fish, poultry, fruits, and vegetables. Products were dipped in melted, thermoplastic wax that immediately hardened as a form-fitting, flexible, easy-to-strip-off wrapper. A method was soon adopted for conveying products through a tank of melted wax and for draining and recovering excess coating material.

A wax-spraying machine was introduced in the early '30's to coat fruits and vegetables and thus prevent decay and withering of products. Oranges, cucumbers, peppers, and the like, are carried through a chamber on a roller conveyor for complete turning. Coating is sprayed from two nozzles above the conveyor under a pressure of 20 to 50 psi. to produce a highly atomized, cool mist for enveloping products. Further along the line, a rotary brush evenly spreads and polishes the wax coating.

Employed as the coating is a blend of waxy ingredients dissolved in a volatile petroleum hydrocarbon solvent, which evaporates before the fine spray particles strike the moving product. The high luster coating on products is about 0.00015 in. thick. Only 3 lb. of wax is needed to cover 80,000 average-size oranges.

Only within the last year was this wax-spraying technique adopted for coating fresh tomatoes.

In 1937, a continuous method was devised for glazing doughnuts. Employed are two stainless steel tanks, one within the other, with the outer one having thermostatically-controlled heating coils. Water heated in the outer tank keeps the glaze free-flowing for pumping. Doughnuts move along a wire-mesh conveyor and under a curtain of glaze flowing from a distributing head, and excess syrup falls into an open tank for re-use.

During the late '40's, coated fresh and frozen meats made an appearance. Fresh meat loaves are still coated chiefly for the sake of enhanced appearance with a mixture of melted lard and gelatin. Frozen meats like chops, pork loins, and roasts were coated with lard, beef tallow, or gelatin. Some were even ice-glazed—an old technique employed to control weight losses and to protect frozen fish from freezer burn.

A special coating—a combination of NDGA-in-oil and Irish moss extractive—was formulated about 1947 to extend the shelf-life of oily fish like mackerel fillets and salmon steaks. Possible application of this coating to other foods is foreseen.

About the same time, nutritionally-improved rice was enriched by spraying the grains with a premix comprising vitamins and minerals. Enrichment ingredients also are sprayed on cereals moving along on a belt conveyor.

Over 40 years ago, gum candies were automatically sugared by a "sanding" machine that handled the 1,000 lb. or so hourly output from a depositor. In 1947, a high-capacity machine was available to take the 5,000 to 6,000-lb. hourly output from a depositor or mogul. Sugar-sanding is done by moistening candies moving along a steaming belt on their way to a sanding drum, where they are tumbled and sugared.

Over a year ago, an air-operated pump was adopted for coating sweet goods with icing or jelly and decorating cakes with frosting. In one practice, the pump is placed over an open drum of jelly and connected by a hose to a T-shaped pipe with perforations to cover a width of jelly rolls traveling on a belt.

By attaching a spray gun to the hose, cup cakes and similar items are covered with a fine mist of jelly to facilitate pick up of shredded coconut farther along the line.

For automatic decorating work, frosting is pumped directly from a mixing bowl through a short hose attached to a horizontal spreader bar mounted over a conveyor. This bar may have as many as four shut-off valves on each outlet so that the number of ribbons of frosting can be varied to suit the type of cake being decorated.

Now used by one firm is a trolley-type conveyor that automatically picks up and dips cookies into a vat of coating. Cookies are next carried through an air-conditioned cooler and then are automatically released from the belt for packaging.

A more recent development is a process for hermetically sealing volatile products against deterioration. It involves forming the liquid flavor in minute droplets which, in turn, are coated with a natural vegetable type of edible gum.

What About the Future?

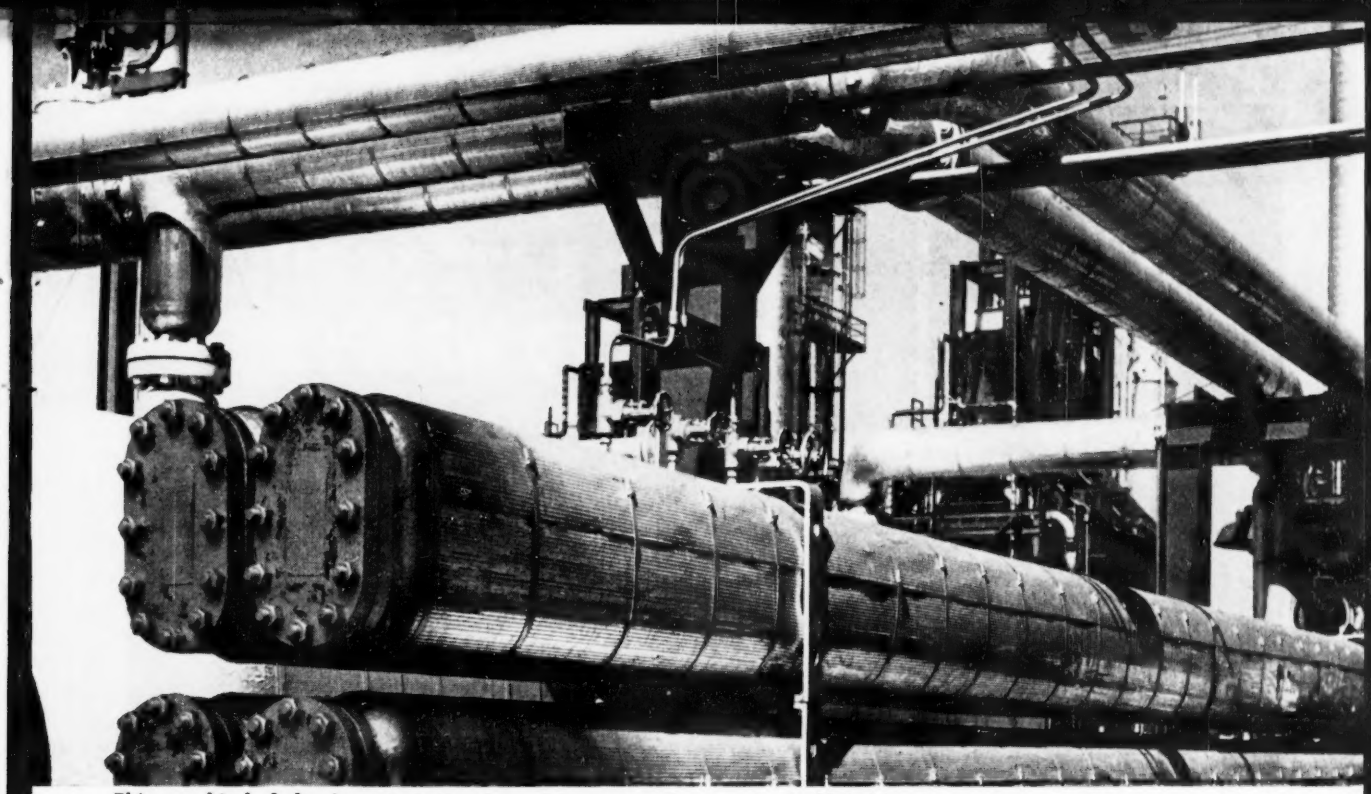
Processors will be "toying" with the idea of adopting the electrostatic-deposition technique for coating a vast array of foods. Coatings emitted from spray nozzles or similar units, for example, may be positively charged and directed onto products traveling on a conveyor at negative potential.

Possible uses are for enrobing candies and cookies with chocolate or compound coatings; waxing fruits, vegetables, meats, fish, and poultry; and applying frostings and flat icings to bakery products.

Taking a cue from present wax-dipping methods, processors will look into the possibility of substituting a continuous, speedy, belt-line technique of coating foods with new molten plastics for machine-wrapping with papers and flexible films.

For faster coating operations, the trend will be toward increasing the speedup of conventional ones. This, in turn, will rapidly give way to newly designed techniques. Eventually, big gains will come from entirely different approaches to performing coating operations.

Sooner or later some food processor likely will apply coatings by a double-extrusion operation. The center of the product will be extruded through a die in the center of a larger annular die. And the coating will flow from the encircling die to form a snug cover on the faster moving center.



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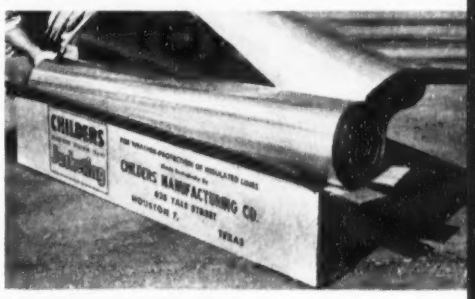

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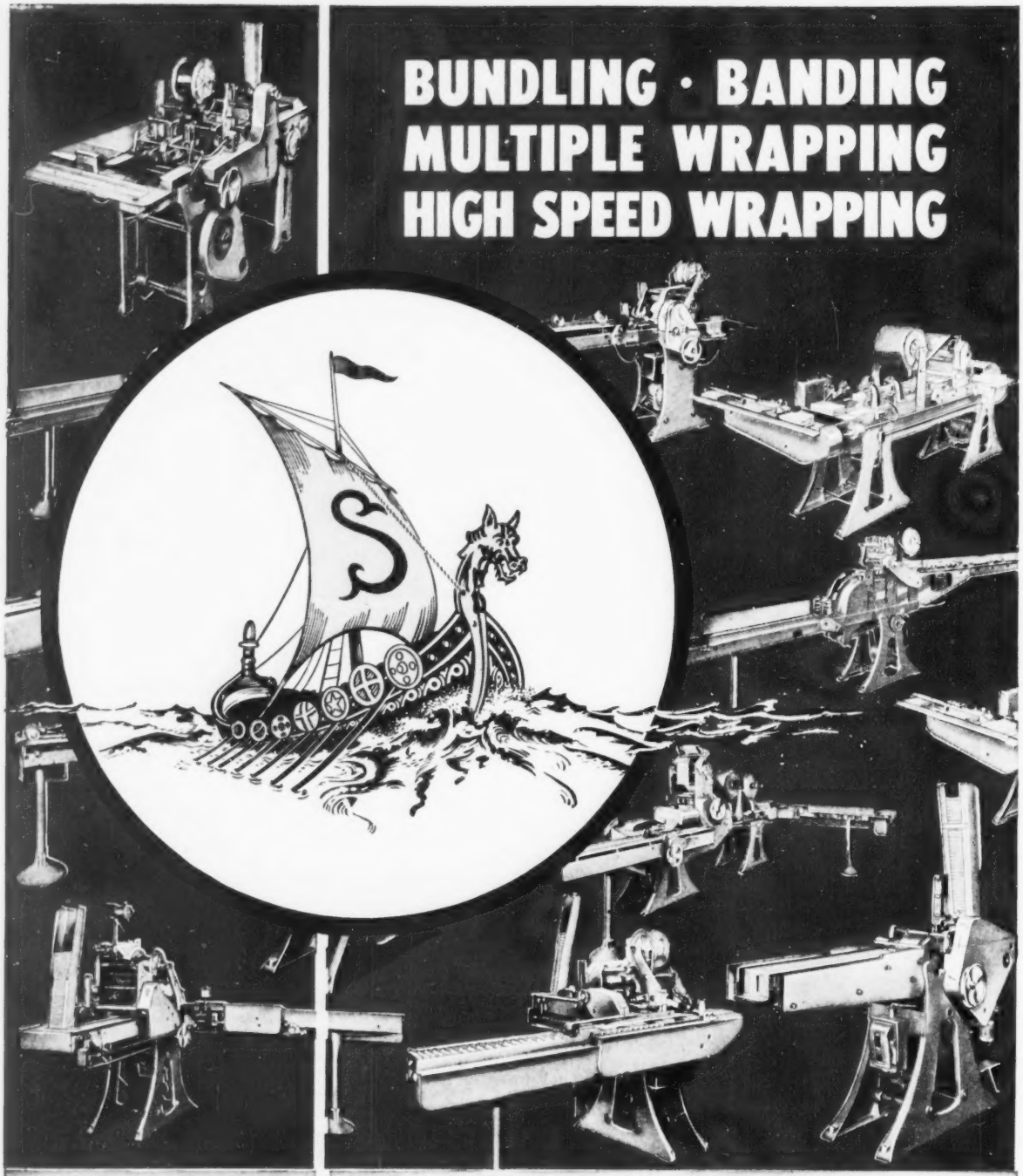

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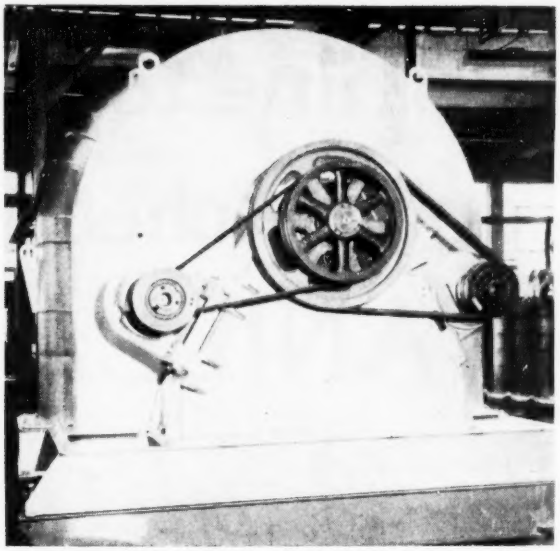
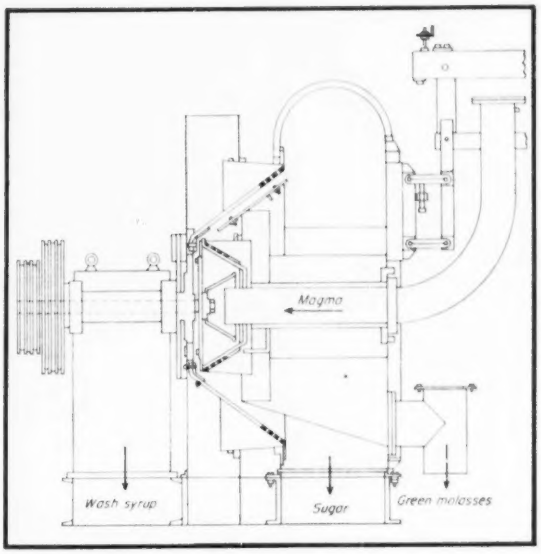
NEW EQUIPMENT & SUPPLIES





New Sugar Centrifugal Separates Continuously

Savings in time, labor and power consumption are foreseen in sugar mills with use of a new continuous centrifugal now being put through operating tests. Rated capacity of new machine is expected to double that of present conventional units.

New machine incorporates vertical multi-baskets, alternately faced, running on concentric shafts and driven via V-belt transmission by two (15 and 10 hp.) general-purpose-construction motors.

Two baskets and accelerating cone are employed. All three rotate in the same direction. Accelerating cone and first, or purging, basket operate from a common shaft and are faced in opposite directions with the cone facing the front of the machine. The second, or drying basket also faces machine front. All three are shaped like the frustrum of a cone. Baskets increase progressively in size.

Sides of the accelerating cone are imperforate. Cone has a 9 in. dia. base, 7 in. depth, and 15 in. dia. outer rim. Purging basket is perforate, has 16 in. dia. base, 9 in. depth, and 27 in. dia. outer rim. Drying basket is also perforate, has 30 in. dia. base, 21 in. depth, and 60 in. dia. at discharge end.

In operation, magma is charged through a steam-jacketed 8 in. pipe to center of accelerating cone. This component, rotating at approximately 600 rpm., feeds magma in a uniform stream to the bottom of purging basket rotating at same speed.

Here, molasses is spun by centrifugal force from crystals as they progress along sides of the perforate basket. Molasses leaves via perforations and is spun off and collected in a chamber which drains via pipe line at the front of the machine.

Meanwhile the partially purged crystals continue along the slope of the basket and are discharged over the outer edge into the base of the drying basket.

This basket, operating on a separate shaft, rotates at approximately 500 rpm. As crystals progress along the wall of this basket by centrifugal force they are subjected to wash-water sprays coming from arranged circular headers installed within the machine.

Washed sugar crystals continue along the slope of drying basket for a short drying period and are spun from discharge end into a sugar collector or casing. They drop through the base of this collector to a conveyor which carries them to the next processing step.

Steam lines incorporated in the unit provide for thorough cleaning of the centrifugal at the shut down period of operation without the necessity of dismantling.

Complete assembly weighs about 8,000 lb. and occupies floor space of 120 sq. ft. Approximate overall dimensions are: Length, 12 ft.; width, 10 ft.; height, 9 ft.—*Hepworth Machine Co., 42-11 Ninth St., Long Island City, N. Y.*

Circle 185A on Reader Service Card

Accurately Feeds, Mixes Micro-Ingredients

Precise, uniform, continuous feeding and mixing of micro-ingredients to formula is reported with use of a new, flexible "equipment package".

Called the Premix Line, it comprises a standard battery of five Model 50 volumetric disc feeders with or without scales, mounted on supporting stand. A single mixing conveyor screw receives ingredients from feeders and conveys them to main feed line.

Feeders and screw are line shaft driven by a single motor and variable speed transmission. Because the entire line is driven by transmission, a change in rate is immediately felt at the discharge end. Each feeder can be adjusted to feed from 1 to 60 lb. per hr. with an accuracy of plus or minus 1 to 3 percent.

In addition, any feeder can be declutched from line shaft at any time whether or not in operation. Standard

Time to double check VANILLA *Quality*

Many manufacturers today are revising their vanilla flavor formulations, and this is the time to put the stress on quality — make a change for the better. The trend is back to real vanilla taste and the standard Alva vanillas have been doing just this job for years.

In selecting any vanilla, pure or imitation, double check it with the finest pure vanilla extract. Then buy the best you can afford.

With the changing vanilla picture it is important that you check the famous Alva vanillas. There are many to suit your needs, both pure and imitation. The Alva laboratories are eager to help. Send us your problem.

PURE VANILLA EXTRACT
The finest extract, processed for over two months.

PURE VANILLA 4X
Same quality as above, four times stronger.

VANILLA-VANILLIN
The best pure extract extended with vanillin.

IMITATION VANILLA 4X
Developed on a natural vanilla bean base.

IMITATION VANILLA 4X (Special)
An inexpensive grade, excellent for specialties.

IMITATION VANILLA
A clean, brilliant flavor, fine as a chocolate stretcher.

VANILLA SUGAR (Imit.)
A dry imitation bean powder.

VAN AMERINGEN-HAEBLER, Inc.
521 West 57th Street, New York 19, New York

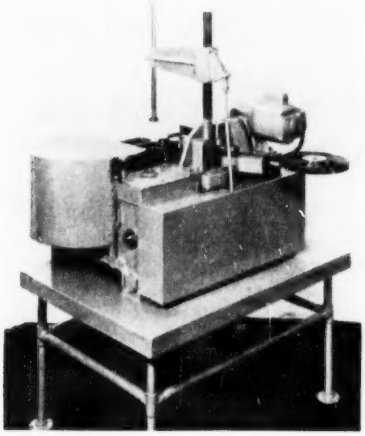
Alva FLAVORS

hoppers hold about ⅝ cu. ft. They can, however, be increased in size up to 4 cu. ft. or kept supplied by means of a chute from a larger supply hopper.

Line is compact, has a minimum of parts and is easy to operate. Line is easily arranged for automatic pacing by main feed flow. Number of units in line can be selected according to mill requirements.—*Omega Machine Co., 345 Harrison Ave., Providence, R. I.*

Circle 185B on Reader Service Card

Unit Speeds Sealing Of Slip-Cover Cans



Faster and more economical sealing of slip cover cans with pressure-sensitive tape, is claimed with use of a new automatic packaging machine.

New unit is able to apply complete seals of plastic film tape (such as "Scotch" brand No. 471 which meets the requirements of specification MIL-T-4239) around can covers at better than 900 cans per hr.

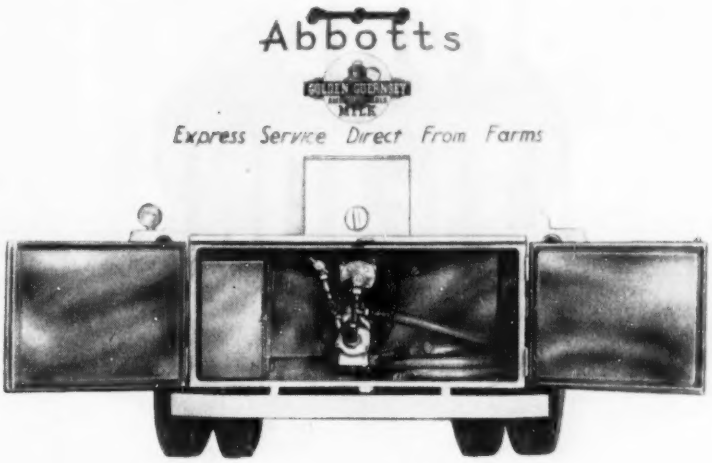
It does the job by automatically starting tape on can; wrapping it as desired with uniform tension and proper amount of overlap; and cutting it at completion of seal. A single operator controls machine.

Machine is designed to handle 2 to 10 in. dia. cans (one setting allowing a 4¼-in. dia. variation), and 1 to 12 in. in height (one setting permitting a 3-in. variation if container can be turned onto its cover during sealing—otherwise machine must be re-set for each new can's height).

Built to fit into existing conveyor set-ups, unit weighs about 450 lb. and occupies a space 2½ ft. wide, 3 ft. long, and 4 ft. in height.—*E and R Machine Co., Parker Rd., Hamburg, N. Y.*

Circle 187A on Reader Service Card

Bulk Tank Truck Expedites Milk Pickups



Fast, quality-pickup under varying conditions characteristic of farm milk-houses is reported with use of this bulk milk tanker—a receiving room on wheels.

To assure low temperature conditions on long runs during hot summer months, pump and sample compartments are refrigerated. Same source of refrigeration provides a tempering effect in extreme winter weather to prevent possible freezing of pump and hose.

High-speed milk transfer at farm and plant is provided by a 70 gpm. centrifugal pump. Pump has few parts and can be cleaned quickly, weighs little and is termed practically pumproof.

Same pump used for pickup can also be used at dairy to agitate milk through a by-pass hookup, standard on all units. A full load of milk is quickly mixed with pump alone, eliminating need for mechanical agitation.

Heavily insulated and completely streamlined, tankers are made in sizes from 500 to 5,000 gal.—*Mojonnier Bros. Co., 4601 W. Ohio St., Chicago 44.*

Circle 187B on Reader Service Card

Cleaner Ready for Use Within Two Minutes

From a cold start, full working pressure is attained in a period of two minutes by this self-contained steam cleaning machine. Unit is capable of discharging 150 gph. of balanced cleaning solution.

It offers a graduated range of cleaning pressures extending from 30 to 100 psi. Heating coil, wound in a helical pattern, provides thermal efficiency of 75 percent minimum.

A wide variety of models is available: Oil-fired and gas-fired; electrically driven and gasoline-engine driven; portable, stationary or trailer. Each can be equipped with remote nozzle control.

Operation is simplified by inclusion of fuel pump designed for fast priming, and new soap pump which eliminates any air lock in soap line. Pressure atomizing burner is inverted, directing combustion downward through heating coil. Coil can be quickly and easily de-sooted without dismantling. All bearings on water pump, except those in motor, are lubricated for life. Pump, motor, and all working parts are readily accessible for inspection and maintenance.

Automatic overheating protection is provided by thermostat controls which cut off fuel supply in event of excessive pressure or temperatures due to water supply failure.

Solution tank holding 15 gal., is equipped with water and steam inlets

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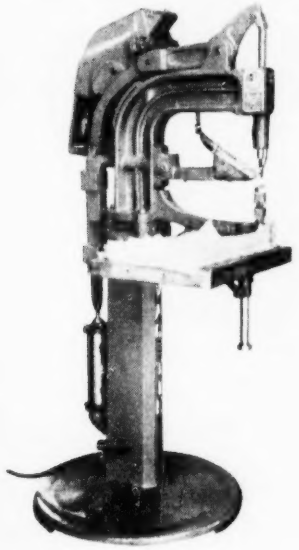
for ease and efficiency in mixing and dissolving detergent concentrate. Twenty-five ft. long, vapor cleaning hose and insulated swivel-handle gun with round nozzle are provided as standard equipment on all models.

All units are equipped with temperature and pressure gages, valves and steam outlet grouped on central panel for operating convenience. Steel enclosure, with hinged panel that is quickly lifted when desired, provides protection for working parts.—*Clayton Manufacturing Co., Box 550, El Monte, Calif.*

Circle 187C on Reader Service Card

Automatic Unit Applies Metal Closure on Bags



Of interest to meat, poultry, and produce men is this new machine which automatically applies a metal airtight closure on cellulose, polyethylene, and saran bags and casings.

In the preparation of pre-tied casings for midget, or small bologna, a single operator with this machine is reported to easily tie 2,000 casings per hr. A casing of double length is used in pre-tying by this method.

Operator grasps casing and twists it at its center. This twist, is then placed into bottom die of machine at a point slightly to right of center of casing. Pressure of operator's foot to actuating pedal brings upper die, holding automatically fed fastener, down to bottom die. Fastener encloses casing and is secured by closing of upper and lower dies.

Casing is then moved slightly to left of center, and another fastener placed around it. Casing is then pulled through a guarded blade attached to machine below die mechanism, and cut between two fasteners, producing two casings pre-tied and ready for stuffing. This method of tying double lengths of casing may also be employed with the polyethylene, Cryovac, or any other type bag, eliminating the need for heat sealing.

After stuffing, an improved method of hanging is injected. This consists of tying off second tie of package in series of two, leaving a 7 in. length of string between pieces. Two smoke sticks are laid parallel on stuffing table, and pieces are easily placed with string across sticks. When sticks are filled to capacity, they are hung in cages. Looping each piece individually is eliminated, and operator handles two pieces faster than he formerly handled one.

Machine is adaptable to poultry field. Operator simply picks bag from conveyor or vacuumizing nozzle, places bag into bottom die of machine and applies a foot pressure to pedal. Upper die lowers and closes fastener around bag.

The fastener may be adjusted to any degree of tightness by simply turning a set screw, thereby allowing an air tight fastener for vacuumized products, or a removable fastener to allow reuse of bag.—*Vac-Tie Fasteners, Inc., 1140 E. Jersey St., Elizabeth, N. J.*

Circle 189A on Reader Service Card

Aluminum Belt Conveyor Is Light, Portable

Increased load capacity and handy belt pitch adjustment are new features reported for redesigned LS aluminum, belt conveyor.

New lightweight unit is termed more convenient to use, and is adjustable to an even wider range of power boosting, stacking and loading jobs than previous models.

Load rating of some models has been stepped up considerably by using a ½ (rather than the former ¼) hp. electric motor to provide added power for the belt.

Conveyor is manufactured in 10 and 16-in. widths and five lengths from 11 to 21 ft. Each model is balanced on free-rolling running gear so one man can easily move it around plant, yard or warehouse.

Another new feature is built-in jackscrew to raise and lower the drive end of unit. This permits fast, accurate adjustment to exact belt pitch wanted after head end of conveyor has been placed in position on a truck dock, tailgate, to meet a warehouse stack.

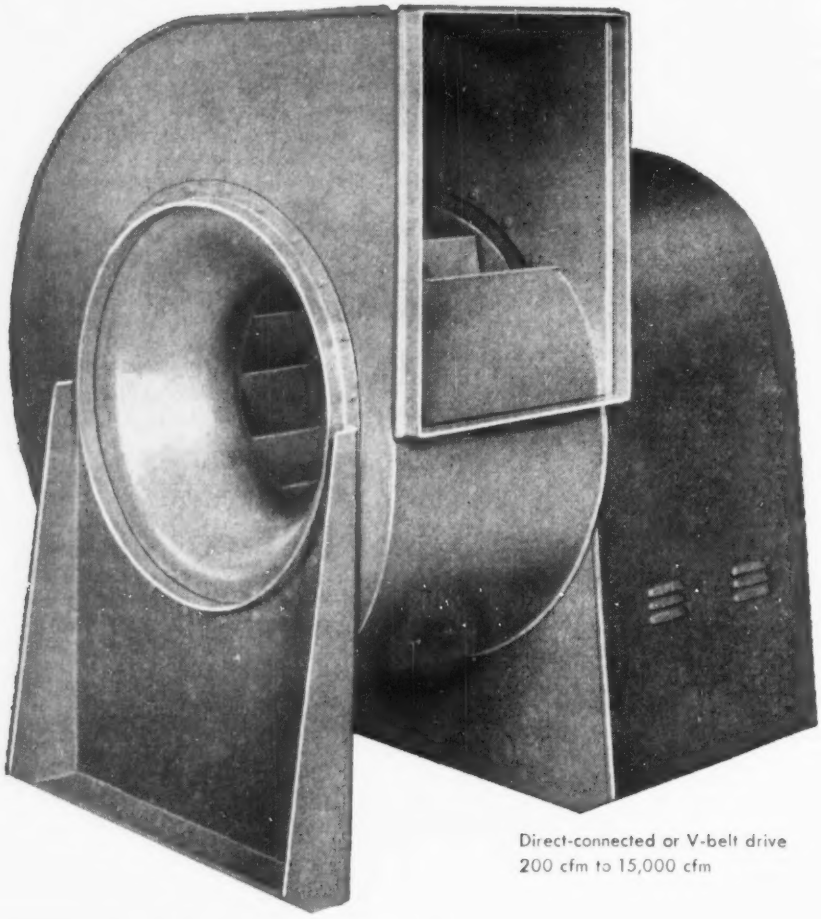
When not in use it can be stored on end and thereby takes up minimum space.

Conveyor is mounted on either two cushion-rubber demountable-tire wheels, two pneumatic-tire wheels, or a dolly equipped with three swivel casters for maneuverability. Ruff-top belt furnished will elevate most materials at inclines up to 40-plus deg.—*Rapids-Standard Co., Inc., 342 Rapistan Bldg., Grand Rapids 2.*

Circle 189B on Reader Service Card

NEW!

ALL-PURPOSE VENTILATING SETS YOU CAN PUT INTO SERVICE FAST!



Direct-connected or V-belt drive
200 cfm to 15,000 cfm

Here's a new line of Westinghouse motor-driven ventilating sets. They are ideal for general purpose ventilation, for exhaust, for processes, and for removal of heat, fumes and vapor.

Where changing plant or building conditions create an unexpected need for ventilation, these sets are a quick solution. Here's why:

COMPACT SIZES—down to 10" x 12" x 16"—take little space, are easy to install.

SINGLE UNIT—fan, motor and drive all made and assembled by Westinghouse.

DIRECTION OF DISCHARGE—can be changed on the job.

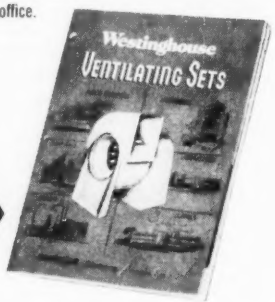
LOW MAINTENANCE permits use of out-of-the-way locations.

WEATHERPROOF COVERS permit outside installation.

SHORT DELIVERIES get your job started sooner.

These ventilating sets are low in first cost, low in operating cost. You get a single warranty because fan and motor are both built by Westinghouse.

For other exclusive features and full information, ask for Catalog 1160. Call your local Westinghouse-Sturtevant office. Or, write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park 36, Massachusetts.

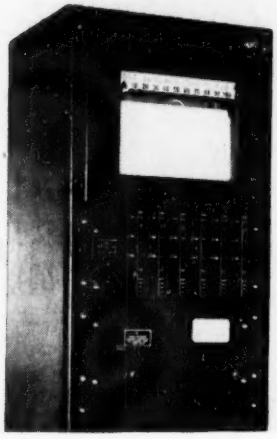


WESTINGHOUSE AIR HANDLING

J-80317

YOU CAN BE SURE ... IF IT'S Westinghouse

Unit Indicates Viscosity From Various Stations

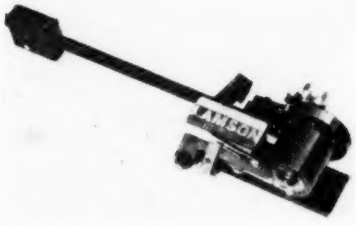


Product viscosity in production can be continuously and automatically measured at 16 stations with Model MP Multi-Probe system.

Hermetically sealed probes, the size of a fountain pen and having no moving parts, are installed permanently in up to 16 kettles or pipe lines. One computer and multiplex unit located up to one mile from probes indicates viscosity measured by any desired probe, or automatically records viscosities singly or in sequence on standard multipoint industrial recorders.—*Ultra-Viscoson Corp., 1240 Main St., Hartford 3, Conn.*

Circle 191A on Reader Service Card

Protects Chain Drives Against Overload



Damage from temporary overloads on chain drives is eliminated with use of this new device. Excessive tension on drive leg trips a limit switch.

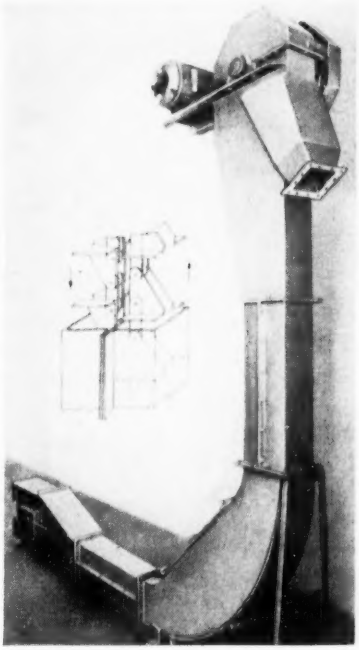
Known as the Overload Protector, unit consists of an eccentrically located idler sprocket counterbalanced by a weight-loaded arm. Counterbalance is adjustable so that device will operate at any chain tension up to 1,000 lb. Design is termed simple, rugged and maintenance-free.

A locking lever is arranged so that manual resetting is required to energize the drive once an overload has caused it to act. With an eccentric sprocket shaft of 0.875 in. dia., the unit can be adapted to chain sizes from ½ to 1¼ in. Electrical capacity of limit switch is 10 amp. at 115v., ac. which can be increased to any desired specification by use of relays.

Shipping weight is 20 lb. and overall dimensions excluding counterbalance arm are 8¾ x 6¾ x 5⅛ in. Counterbalance arm extends 13 in.—*Lamson Corp., Syracuse 1, N. Y.*

Circle 191B on Reader Service Card

Dust-Tight Unit Moves Drys in Three Planes



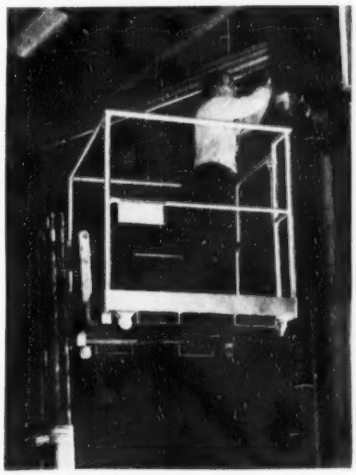
Dry, granular bulk materials such as grain, can be moved horizontally, vertically, or along inclined planes with this dust-tight conveyor.

Known as Flowmaster, it comprises an enclosed endless chain fitted with specially designed flights which move material along in a continuous stream. Unit is particularly adaptable to medium and low-capacity operations; where economy is a factor; and in which there must be no voids in the flow of material to processing or packaging equipment.

Conveyor is readily designed into tight spaces and around existing equipment. It is both self-loading and self-discharging.—*Gifford-Wood Co., Hudson, N. Y.*

Circle 191C on Reader Service Card

Safety Platform Speeds Maintenance Tasks



Time and labor are saved, and hazards minimized on maintenance and repair jobs with use of this platform in conjunction with a fork-lift truck.

Built according to safety regulations, platform has four-way fork entry. It is 42 in. wide, 42 in. long, and has a chest-level safety railing with hinged gate at one side. Floor is faced with a 4 in. toe plate and entire unit is mounted on 3 in. rubber casters for easy-rolling when not in use. All-metal, light weight, portable tool box, designed to fit the platform may be obtained as an accessory.—*Hamerslag Equipment Co., 45 Elmira St., San Francisco 24, Calif.*

Circle 191D on Reader Service Card

Taper-Type Beer Tanks Offer Many Advantages

Improved filling, easier cleaning and more efficient product-quality protection are advantages reported for a new type, tapering, beer-storage tank.

Taper is stated to eliminate air pockets on top of filled, glassed-steel tank. Such air pockets may cause oxidation, spoiling brew. Tilting of tanks facilitates emptying and drainage after cleaning. In filling operations, gradual

Want More Information?

It's free—and easy to get. Simply note here the items on which you want more details, then circle each key number (there's one given at the bottom of each item) on the handy Reader Service postcard—page 207. Then sign at the bottom and mail.

For your convenience, too, items in this department are listed and keyed in the Reader Service Section.

How to get the most for your money . . . in materials handling equipment

The CLARK EQUIPMENT COMPANY has produced and sold more than 150,000 trucks. This is a wide margin of leadership over anyone else in the materials handling business. We state this fact because we believe it has important bearing on your selection of materials handling equipment.

These are the reasons for CLARK's leadership:

1. Superior products

Obviously, to set sales records in an industry where there are many good companies, CLARK's product has had to excel. Industrial buyers are well-informed; they do not buy on the basis of advertising claims. The fact that more than 150,000 CLARKs have been bought by this select market speaks volumes for the product's quality.

2. Superior services

There is a lot more to selling materials handling equipment than merely "selling". The industrial customer buys equipment to do a job: to cut costs, to improve efficiency. CLARK has always felt responsible for giving the customer the right truck for the job, and then helping him get the most benefit from it. In other words, proper use of the equipment. CLARK's knowledge of materials handling can be measured in terms of 150,000 units of experience, more experience than any other industrial truck manufacturer. This, in addition to the equipment itself, is what you get when you do business with CLARK:

Methods engineering
Plant surveys
Factory field service and counsel
Dealer service and counsel
Preventive maintenance training
Driver training
Service school
Service parts
Continuing product and methods research

When you do business with CLARK, you get the most for your money. That simple fact explains why more people buy CLARKs than any other truck.

Very truly yours,

Your CLARK Dealer

Note: I'm listed under "Trucks, Industrial," in the Yellow Pages of your telephone directory.

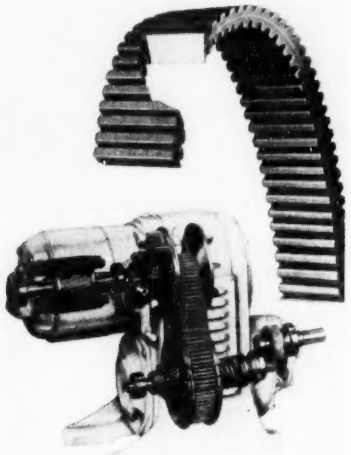
taper, from front to rear, results in insignificant loss of barrelage which is more than made up by elimination of overflow and waste of good beer.

Operation of test installation, comprised of 15 tapered units each with a capacity of more than 1,000 bbl., showed considerable savings effected.

If new tank is recessed behind wall, danger of spillage is eliminated since air or relief valve is located near front head. Tank construction allows for even distribution of load whether suspended on end or on intermediate supports.—*Pfaudler Co., 1000 West Ave., Rochester 3, N. Y.*

Circle 191E on Reader Service Card

Power Transmission Belt Reduces Space Needs



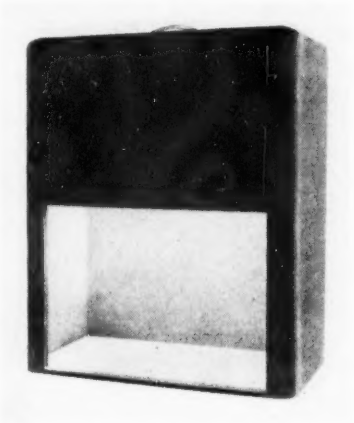
Greater horsepower within a smaller space is reported with use of newly designed power transmission V-belt on variable speed motors.

New design reduces internal friction and permits greater flexibility. Thus, greater speeds can be combined with smaller diameters. Outer periphery is relieved of destructive tensile strains; inner periphery is free from excess compression. Belt bends easily.

Varibelts are constructed of synthetic rubber compound which has proven enduring for variable speed drives. They are built up in layers, then cured under pressure in precision molds. Use of synthetic fiber adds strength and permits employment of small cords to minimize heat. Belt is resistant to heat, oil and grease, and is protected from drippings by enclosure. —*U. S. Electrical Motors Inc., Box 2058, Los Angeles 54.*

Circle 193A on Reader Service Card

Portable Lamp Simplifies Accurate Color Grading



Proper lighting for accurate color-quality control and grading of foods and food products is claimed with use of this new lamp.

Called the Executive, it is a portable, desk top lamp measuring 21x22x 11½ in. It is stated to produce over a limited area the same north sky illumination provided by standard skylight.

Portability and size of unit permit its use at numerous locations. Lamp comes as a complete unit and operates from normal ac. power.—*Macbeth Daylighting Corp., P. O. Box 950, Newburgh, N. Y.*

Circle 193B on Reader Service Card

New Insulating Board Is Strong and Light

Strength and light weight are advantages claimed for new insulating board aimed for use in roofs, walls, and self-sustaining partitions of cold storage and freezer rooms.

Board, 2 in. thick, is available in standard sizes of 12x36 in., 24x48 in., and special sizes up to 48x72 in.

Low thermal conductivity (K factor) of .30 Btu., and low moisture absorption are said to make board particularly effective for cold storage and other commercial applications. Compressive strength is rated at 7.06 psi. Weight is 11 lb. plus or minus per cu. ft.

Board is composed primarily of Redwood bark fibers, and is said to be odorless, repellant to rodents and insects, resistant to fungus or decay, and to allow moisture to migrate freely through the material. Latter is claimed to prevent destruction of material or lowering of efficiency.

Prior to offering board to general markets, substantial quantities were installed in freezer plants, refrigerated warehouses, and other service applications to test performance under actual operating conditions.—*Pacific Lumber Co., 100 Bush St., San Francisco 4.*

Circle 193C on Reader Service Card

Insulated Shipper For Frozen Foods

Economies in the distribution of frozen food are reported with use of new, flexible-wall insulated shipper.

Known as the Freezerator, it permits shipment of frozen foods and perishables in non-refrigerated trucks at low cost. Tested by qualified laboratories, this insulated shipper was reported to have high thermal efficiency and long life expectancy. Besides economies of shipping, collapsible container provides appreciable savings in storage space.

Made of neoprene coated nylon, with a multiplicity of layers for increased insulation, it is waterproofed, uses reinforced cotton insulation. Container measures 20 in. wide by 24 in. long and 18½ in. deep. Its capacity is 5 cu. ft. Weight is 20 lb.—*Marty Gilman, Inc., Gilman, Conn.*

Circle 193D on Reader Service Card

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How to SAVE MONEY on CARTONS

Model PA carton former in plant of Mars, Inc.

Why pay more for your cartons than you have to? Like many other manufacturers, you will probably find that you can make them by machine from low-cost die-cut blanks — *at striking savings.*

Our Model PA carton forming machine, which occupies only 3′ x 6′ of floor space, forms and glues the blanks at speeds up to 102 a minute. Requires only part-time attention of an attendant. Delivers the finished cartons right-side-up, ready for filling. Easily adjustable for different sizes.

No labor problem. No large inventory of cartons to carry in stock — you make them as you need them, and the flat blanks require far less storage space.

The Model PA carton former is adaptable to many different types of cartons. Uses any kind of carton stock, including corrugated material.

We suggest that you consult our nearest office, sending samples of your cartons.

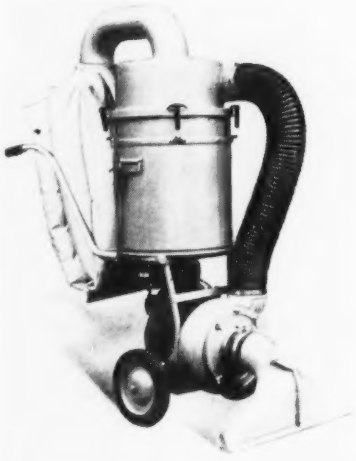
Write for literature

PACKAGE MACHINERY COMPANY
SPRINGFIELD, MASSACHUSETTS

NEW YORK PHILADELPHIA BOSTON CLEVELAND CHICAGO ATLANTA
DALLAS DENVER LOS ANGELES SAN FRANCISCO SEATTLE TORONTO MEXICO, D.F.

New Equipment

Floor Cleaner Handles Dust, Powder, Litter

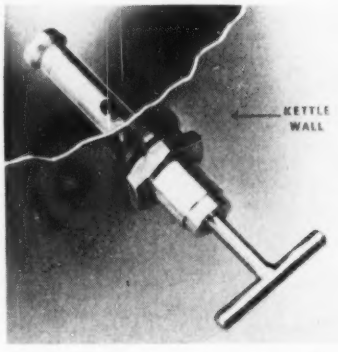


Speed and efficiency in collecting dust, powder, and ordinary traffic litter from factory floors and warehouses is claimed with use of this Floormobile. Machine has a large suction nozzle mounted in fixed position just above floor surface. Nozzle air-cleans a 22 in. path at speeds up to 20,000 sq. ft. per hr.

A wide orifice (31.4 sq. in.) permits collection of large pieces of scrap and litter without clogging. Units is available with gasoline or electric power capable of moving 860 cfm.—*Handling Devices Co., Inc., 43-45 Pearl St., Brookline 46, Mass.*

Circle 194A on Reader Service Card

Simplifies Sample Taking From Cooking Vessels



Accurate product samples can be removed from steam cooking kettles in an efficient and sanitary manner with use of the new "Spoon Sampler."

Device is furnished complete with rubber gaskets and locknut, ready to install by simply cutting a 2⅛ in. circle in the cylindrical section of

New Equipment

vacuum pan just above steam jacket. Unit cannot be installed through steam jacket unless done at maker's factory.

Sampler is made of machine-polished stainless steel, and features no piping cocks, cracks nor corners to collect food residue. It has no valves to leak or plug. Accurate samples (1.17 cu. in.) are taken direct from inside kettle.—*Hamilton Copper & Brass Works*, 820 State Ave., Cincinnati.

Circle 194B on Reader Service Card

Thermocouple Head Is Easy to Install

Ease of installation and service are reported for a new thermocouple head. Named "Serv-Rite", its over-all size is functionally designed for compactness.

Both base and cap are made of malleable iron for extra strength and cadmium-plated for resistance to corrosion. A new style friction-lock cap can be tightened or removed by a quarter turn. Within the cap is asbestos gasket to assure dirt- and moisture-tight head. Connector block is of heat-resistant material selected to withstand temperatures up to 900 deg. F. in continuous service.

New, improved type of insert simplifies head wire connections. Design of thermocouple head permits easy withdrawal of complete element including connector block. A choice of ½, ¾, and 1 in. IPS protecting tube opening is available.—*Claud S. Gordon Co.*, 3000 S. Wallace St., Chicago 16.

Circle 195A on Reader Service Card

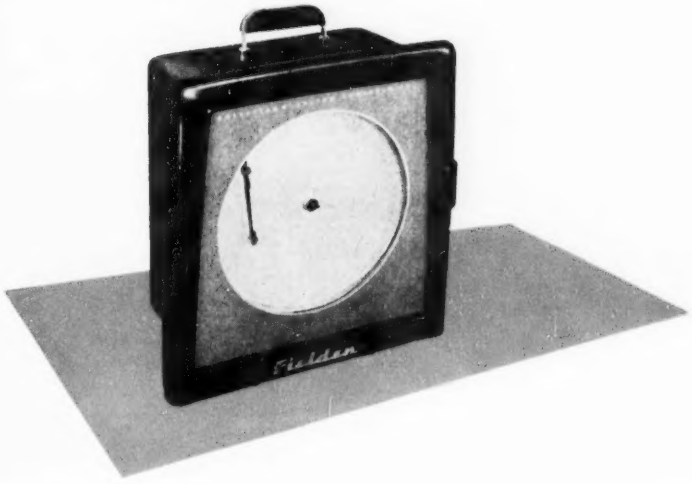
New Chemicals

High Gloss Floor Finish Has Slip Resistance

Without buffing, a high gloss finish is reported with use of Gripsheen, a new water-based industrial floor material having slip resistant qualities.

According to maker material pro-

accurate instrumentation need not be costly



here's proof . . . Accurate to ± 1% of full scale, this Fielden TEKTOLOG Electronic Recorder has a sensitivity of ± 0.1% and reproducibility of ± 0.5%. Yet it sells at a price substantially below that of servo-operated potentiometer-type recorders!

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For more information, use coupon on page 207.

(DEMING PUMP SPEAKING)

"I work in a knitting mill. My job is to recirculate a corrosive liquid bleach through a tank with heating coils. The hot solution is then sprayed into vats which hold about 3000 lbs. of unbleached cloth. I pump for about 9 hours at a stretch. Then I rest for about 1½ hours while they unload the bleached cloth from the vats. Then I start pumping on my next 9 hours' stretch.

"I've been on this job for 1½ years with no layoff due to me. My boss hasn't spent a nickel for repairs or maintenance on my account. He says that the pumps I replaced on this job cost him plenty in upkeep. They were run by V-belts which would rot out and the pump bearings would corrode and freeze. Other troubles included the loss of many a batch of ruined cloth. So he tells me I cured a lot of headaches and reduced a lot of costs."

(The Deming Pump speaking is a standard Fig. 4612 with regular drip proof motor. Full details on request.)

Send for BULLETIN NO. 4600-A

This illustrated bulletin gives you plenty of facts on the latest models of Deming Sump Pumps.

THE DEMING COMPANY
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Specify DEMING PUMPS

New Equipment

vides high traction on any kind of floor including terrazo. It is said to have high wearability, is quick drying and and easy to apply. One gal. will cover 1,000-1,500 sq. ft.

Another advantage company states, is that small floor areas may be patched without necessity of refinishing entire surface. Material blends well with surrounding areas without showing overlap marks. In addition, new floor finish is easily maintained by damp mopping. —*West Disinfecting Co., Long Island City, N. Y.*

Circle 195B on Reader Service Card

Product Replaces Coumarin

Dolcourin, a new product, has been developed for use in foods as a replacement for the recently discredited coumarin (FE, July p 189).

New material contains no coumarin or its derivatives whatsoever. Maker suggests that new product be used as a partial or complete replacement in any formula where coumarin or tonka has been employed. New material is reported high in fixative value and approximately equal in flavor strength and tonal quality to coumarin.—*Dodge & Olcott, Inc., 180 Varrick St., New York 14.*

Circle 196A on Reader Service Card

—*End*—

Packaging Materials

—*Continued from page 118*

provide the container with strength and form. Significant has been the development of weatherproof V-boxes during the war. Recently introduced are fiber boxes with glued lap joints.

Fiber Drums. Used in the construction of these drums are special protective linings or coatings as well as water-vapor barriers. They are made with a film of asphaltic material or lined with materials such as foil, Pliofilm, cellulose acetate, and the like. Also, they are treated with special waxes or resins. Their exteriors are sometimes lacquered or coated with pigmented paints to provide attractive finishes. Lined with greaseproof materials, these drums are used for lard and shortening. Those with vaporproof barriers and tight closures are used for bulk-packaging of dry foods.

Textile Bags. One of the oldest forms of bulk package is the textile bag. Recently, plastic coatings and laminations have extended their usefulness.

Multiwall Bags. By specially treating the inner walls, these bags are

finding a wide range of applications. Newer types are being developed for further food uses. Treatments include impregnating, coating, and laminating kraft paper. Even the pulp is being treated with sizings, waxes, and synthetic resins. Recently, bags have been designed for the moisture-containing foods like meats and peeled potatoes. And also polyethylene, Pliofilm, foil, parchment, and glassine are being used as liners for protective purposes.

What About the Future?

Less attention will be directed toward extending product shelf-life. Instead, more thought will be given toward selecting low-cost protective materials for faster line throughput and closely gearing production to orders with the object of moving products more rapidly from plant to consumer. Significant, too, will be the reduction in in-plant storage space.

By following this course, one large food processor has saved many thousands of dollars in a year.

Attention will be sharply focused on improving materials and containers for higher speed packaging-line performance. Urgency of having these materials geared to maximum production will be attributed to the rising cost of materials, labor, equipment.

In some food plants, half of the labor cost is involved in packaging. And with the development of more continuous operations and higher speed machines, efforts will be centered on breaking the packaging bottleneck.

Look for large food processors purchasing materials in roll form for making bags, cartons, cans, and labels that will be directly fed to packaging lines. Where practical, switching from rigid to the lower cost flexible materials will be further accented.

But what must you, as a food processor, do to take advantage of the cost-saving benefits of new materials, containers, machines, and techniques coming up in the next 25 years?

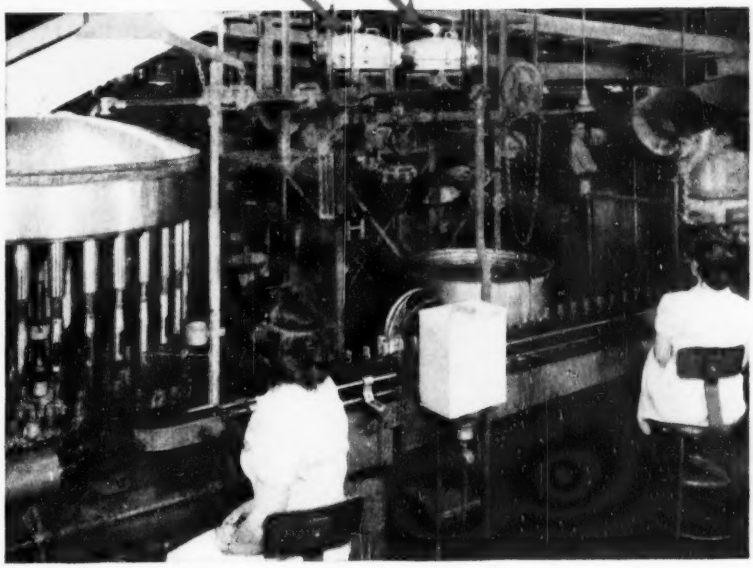
Recommended is the formation of a packaging committee with members representing the packaging section of the research laboratories as well the purchasing, production, and quality control departments. Through the cooperative efforts of these departments, it will be possible to select better, low-cost materials and faster machines.

Efforts of this committee can, therefore, be directed toward developing packages for higher output, studying the effect of materials on packaging speeds, setting up a foolproof method of ordering supplies, and establishing an efficient system of prechecking incoming materials.

End (*Resume reading on page 121*)

SPARKLER HORIZONTAL PLATE FILTERS

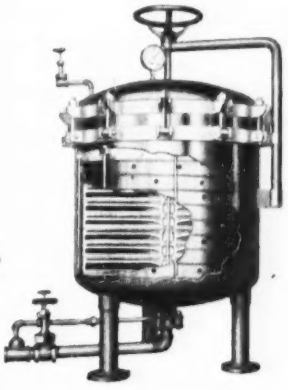
for final polishing of whiskey at the bottling line



THE two Sparkler filters shown here in one of the bottling lines at National Distillers give a safety filtering to the whiskey that practically eliminates discards due to fine specks or pipe line particles in the finished product.

By using two bottling line filters it is not necessary to shut-down production to clean filters. Either one of these filters can handle the required flow rate during the short time required to change the filter media on Sparkler horizontal filter plates. The cost of filter paper to re-dress the plates in these filters is very low and a complete change can be made and the filter back in operation in a few minutes.

Sparkler horizontal plate filters have become widely used in the production of whiskey for filtering at all stages because of their reliability for fine, consistent, never-degenerating quality, and low operating cost.



SPARKLER

Write Mr. Eric Anderson for help on your filtration engineering problems and personal attention to your requirements.

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NEW PACKAGES & PRODUCTS

Calibrated Casing and Sealing for Chunk Sausage

Packer, retailer, and consumer benefit by a new method developed by Transparent Package Co., Chicago, for casing and chunk slicing sausage.

The casing allows for maximum brand identification and is calibrated for chunk slicing. Called "Tee-Pak", the 1⅞ in., 2¼ in., and 2¾ in., stock casings are marked for 12 slice and 20 slice chunks. One stick yields as many as four 20-slice chunks and three 12-slice chunks. Slicing marks are indicated on casings as a guide for consumers.

A special small portable sealer, called "Uni-Pak'R", for wrapping the chunks is designed so that the wrap in which the chunk is sealed during the packaging operation, permits close contact with the entire surface of product. This overall contact on the cut surfaces aids greatly in preserving the bloom of product. This sealer was developed by the above named company with the assistance of Pliofilm Div., Goodyear Tire & Rubber Co., Akron, who furnish the Pliofilm and Cleveland Lathe & Machinery Co., Cleveland.

For Package Data Use Reader Service, p. 207

Sugar Stays Soft

American Sugar Refining Co., New York City, is now packaging its "Domino" light brown, old fashioned brown, and confectioners sugar in a new "Stay-Soft" package. Lumping and caking of these sugars during shelf life has long been a problem. After considerable research the present package was designed. It is said to keep product soft and smooth in texture. In the case of the confectioners sugar 3 percent cornstarch has been added to the 1-lb. package which aids in keeping it fluffy.

Packed in the familiar red, yellow, and blue chipboard cartons the difference in the new pack lies in the fact that the sugar itself is first packaged in a specially treated glassine waxed liner bag. This bag is carefully folded at top to form a protective seal. Instructions are given on package for consumer to be sure to fold liner and tuck in flap after opening. Package carries a bold red and yellow poster-type imprint calling attention of the consumer to the new "stay-soft" feature.

Pitted, Pasteurized Dates

Date packers have been constantly improving methods of packaging dates for consumer trade. Formerly sold in bulk from a large block most dates are now available in individual packs. An excellent example of fine packaging is the "Bordo" pitted dates being marketed by Bordo Products Co., of Chicago.

Not only have they succeeded in putting out a fine package but the processing method used is worthy of mention. Imported from Iraq, the pitted dates are pasteurized and tenderized in stainless steel vacuum chambers of exacting specifications. Method used is reported to keep the dates fresh and assure a quality product.

After processing, dates are packed in 7-oz., two-section, set-up chipboard cartons which have inner protective liners of corrugated paper. Box itself is colorfully designed and has a cellophane window on top. Bottom of carton carries illustrated recipes. To assure freshness and extra protection carton is then overwrapped and heat-sealed with moisture-proof, air-tight, opaque cellophane (Milprint, Inc., Milwaukee). Design of overwrap gives the impression of seeing dates within package. Side of overwrap carries suggested recipe.

For Package Data Use Reader Service, p. 207

Pre-Sealed Packaging

Production costs of cooked and baked meat loaves and boneless hams reportedly are being cut by use of a new Pliofilm end seal, developed by Milprint, Inc., Milwaukee.

Super Mil-O-Seal, as it is called, is designed to allow packaging of square loaves through its formation of gussets. Special vents near seal permit air to escape as loaf is inserted. Design features automatic positioning so there is no need to twist casing for proper wrap fit.

For Package Data Use Reader Service, p. 207

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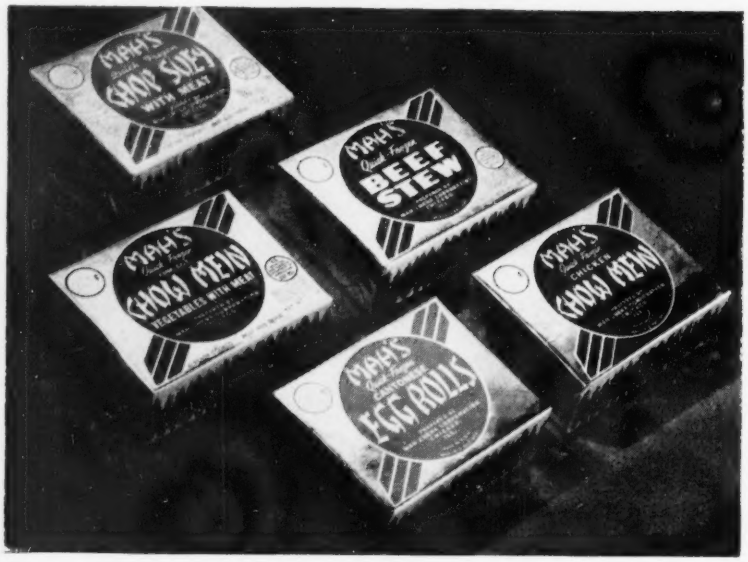


Frozen Chinese Food Gains in Popularity

Starting with a single frozen product—chop suey—6 years ago, Mah Chena Corp., Chicago, has expanded its line to five different kinds of Chinese foods, which are now being distributed in 38 states as well as Canada and Mexico. These other products include chicken chow mein, vegetable chow mein with meat, Cantonese egg rolls, and beef stew.

Processed under the personal supervision of Mr. Mah, well-known chef and restaurant manager, products are prepared in a modern, sanitary plant under continuous U. S. government inspection.

Being a specialty food, company realizes importance of eye appealing packages to put its products before the consumer. To achieve this, all items are packed in gaily colored aluminum foil overwraps (Millprint, Inc., Milwaukee). Different colors provide easy distinction between products, and make for attention compelling packs in display cases. Chop suey pack has a red and white design against a gleaming silver background; egg roll is in red and yellow; beef stew in brown and white; chicken chow mein in blue and yellow, and vegetable chow mein in blue and white. Design on each is an elaboration of the Mah Chena "circle and bars" trademark.

For Package Data Use Reader Service, p. 207

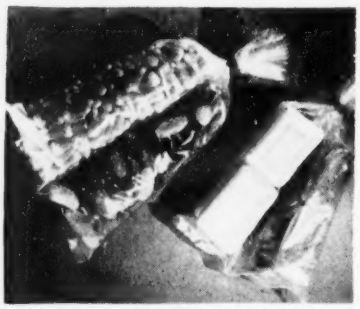
Two-Flavor Newton Bar

A peach-apricot flavored newton-type cookie is being marketed by Farm Crest Bakeries, Inc., Detroit, Mich. and Columbus, O., under its "Farm Crest" label.

Product is packaged in 1-lb. interlocking paperboard tray, (Ohio Boxboard Co., Rittman, O.) and overwrapped in transparent cellophane to give complete visibility and appetite appeal to the cookies which are placed in two rows of 10 each.

Carton is colorfully designed in green, peach, and white. Prominently displayed on sides and bottom is the company's slogan—"No Foolin'—They're Good!"

For Package Data Use Reader Service, p. 207



Divided "Poly" Bag

With the growing popularity and consumer acceptance of fractional packages, the 2-in-1 polyethylene bags now being offered by Plastic Packag-

ing Co., Chicago, should be of considerable interest to packers.

The bags, offered in a wide variety of sizes and shapes, are made of pure polyethylene and are guaranteed to be water and aid tight, free from all types of additives such as plasticizers and stabilizers. Also, they are chemically inert, odorless, tasteless, and non-toxic, thus lending themselves to use in a wide field of food products.

In addition to their use for fractional packaging they can also be successfully used for tie-in or combination merchandising, such as popcorn and shortening, spaghetti and sauce or cheese, etc.

For Package Data Use Reader Service, p. 207

Package & Products Shorts

Dietetic Offerings Continue to Grow

A dietetic ice cream, containing no sugar or saccharin, is being marketed by Steffen Dairy Foods Co., Wichita, Kan.

For salt-free diets: a new cellu sodium-free baking powder, offered by Chicago Dietetic Supply House, Inc., Chicago.

Cream-Wipt Foods Products Co., Philadelphia, offers a new starch-free salad dressing.

Ready Mix for Institutional Trade

A potato pancake mix, in 15-lb. metal containers, has been introduced by The Institutional Food Products Co., New York City. Contents of 15-lb. container will produce 300 large size pancakes.

Baby Cereal in Small Size Variety Pack

Gerber Products Co., Fremont, Mich., has introduced its baby cereal "Quads" pack, consisting of 4 small individual boxes, one each of rice, barley, oatmeal and a mixed cereal. These are packaged as a unit and colorfully overwrapped in cellophane.

Meat to Eat in a Cone

Novel idea introduced by Miles Manufacturers, Inc., Kansas City, Mo., is its "Chili-in-Cone". This consists of chile con carne served in a cone and eaten without use of any utensils. Said to be popular at sports and other outdoor events.

Tube Dispenser for Jelly

A 6-oz. tube, 1¼x7¼ in., containing apple-raspberry jelly has been added to present line of C. H. Musselman Co., Biglerville, Pa.

Ready-to-Fry Frozen Shrimp Cakes

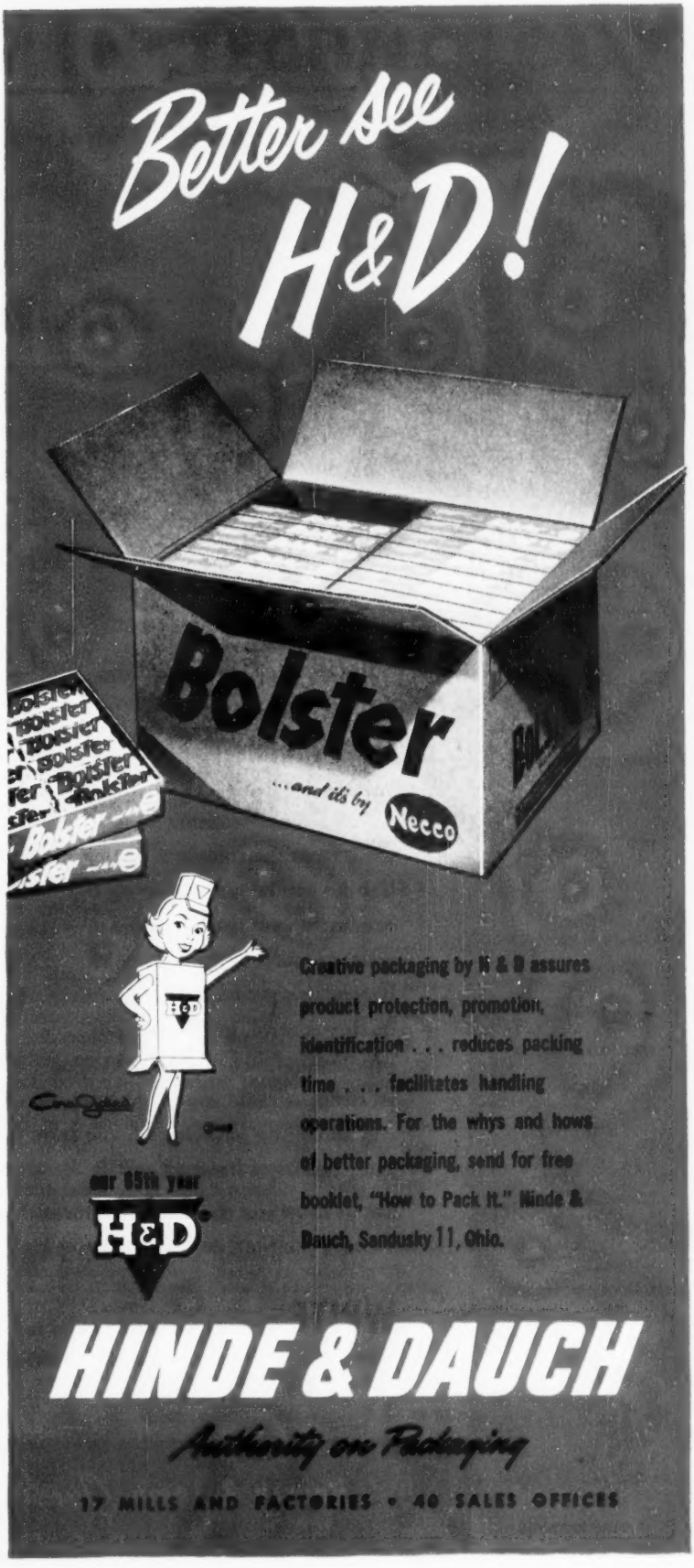
Frozen shrimp cakes, consisting of shrimp, eggs, onion, seasoning, and bread crumbs are being marketed by Leigh Foods, Inc., New York City, under the "Flamingo" label. Both retail and institutional packs are being offered.

Tea and Crumpets

Specially tailored for toasting is the new "butter crumpet" being marketed by Arnold Bakers, Inc. Split evenly in the middle to fit in toaster, muffin is large enough to pop up above toaster edge. They are made from creamery butter, unbleached flour, buttermilk solids, yeast and salt.

Never-Leak Container

A new "never leak" being used for shipment of meats and other moist products, has been developed by Hinde & Dauch, Sandusky, O. Container, capable of holding liquids for weeks without leaking, is of one-piece, die-cut corrugated construction.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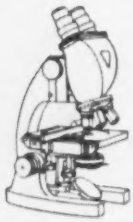
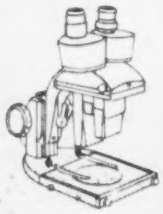


LABORATORY MICROSCOPES



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for the Food Industry

ADVANCES IN TECHNOLOGY

Enzymes Responsible for Rancidity in Butter Not Inactivated at Pasteurizing Temperature

Pasteurization of cream for buttermaking has been depended upon not only to destroy *P. fragi* and other defect-producing bacteria, but also to inactivate many of the potentially deleterious enzymes which may have been produced by the microorganisms.

But now it has been proven that, although pasteurization does destroy *P. fragi*, much of the lipase produced by this organism remains active after this treatment and may cause pronounced rancidity in butter made from properly pasteurized cream.

Also determined by the experimental procedures were: (1) That salting of butter has no appreciable effect on activity of residual enzymes; (2) lipase is active in cream between pH 4.98.2, with an optimum between 5.7-6.6; (3) extensive growth of *S. lactis* does not cause appreciable inhibition of growth of *P. fragi* by markedly reduced lipase production and activity, and (4) butter containing residual lipase undergoes considerable fat degradation during storage at 15 F., developing rancid flavor.

Digest from "The Lipase of *Pseudomonas Fragi* III. Enzyme Action in Cream and Butter," by S. A. Nashif and F. E. Nelson, *Journal of Dairy Science*, 481-88, May 1953.

Slow Cheese Starters

Bacteriophage infection in cheese factories using *Streptococcus cremoris* or *S. lactis* starters can lead to long delays in acid development or to its complete collapse.

Origin of the phage is unknown but it is usually attributed to farm animals, and it is believed that it is also a dust-borne infection. In commercial equipment that is never completely sterilized, phage reinfection of milk from day to day is almost certain as long as a susceptible strain of starter is used. Strain specificity offers one means of protection against phages.

Starter cultures should be prepared in closed, sterilizable vats, preferably in a separate building that can be supplied with sterilized and filtered air. Failing this, air sterilization in the culture room or area where cultures are grown is also useful. Several strains of starter organisms should be available and should be used in pairs in rotation, changing them every 4-5 days. In this way phages will have less chance of becoming established.

Methods of disposal of cheese whey are an important factor in the prevention of infections. Transporting whey in milk cans back to the farms for animal feeding can reinfect milk coming from that farm. Careful laboratory control of starter cultures and of factory sanitation will also aid in controlling it.

Digest from "Bacteriophage in Cheese Manufacture" by H. R. Whitehead, *Bacteriological Reviews*, Vol. 17, No. 2, 109-23, June 1953.

No Uniformity Found In Cheese Crystals

White particles found in aged cheddar cheese are comprised of calcium lactate, tyrosine, cystine and leucine. However, considerable variation exists in quantitative concentration of the various substances.

Particles were collected from 6 samples of cheddar ages from 18 to 150 months. Three samples were made from pasteurized and three from raw milk. Tyrosine concentration varied from 3-50 percent.

No evidence was found that heat treatment of cheese milk influenced particle composition. But method of ripening appears to have a definite effect as indicated by the composition of particles from a sample packaged in a laminated wrapper under vacuum. This sample had the lowest percentage of tyrosine, no detectable calcium lactate, and a high percentage of leucine.

Digest from "Observations on the Chemical Composition of White Particles in Several Lots of Cheddar Cheese," by W. J. Harper, A. M. Swanson and H. H. Sommer, *Journal of Dairy Science*, 368-72, April 1953.

Inhibits Rancidity In Butter

Addition of a special antioxidant to milk, sour or sweet cream before churning, or to butter granules of butter itself, will prevent development of off-flavors in cold storage butter according to a recent patent.

Antioxidant—dialkyldithiocarbamic acid—may be added directly, or as a salt. Due to its ready solubility in water, the Na salt is preferred. Quantities range from 0.0005-0.2% of butterfat present in product.

Digest from U. S. Patent 2,638,420, issued May 12, 1953 on an application dated June 15, 1951 to F. D. Tollenaar, Utrecht, Netherlands, assigned to de Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek ten beheeve van de Voeding, The Hague.

FRUITS

Apple Juice Quality

Ripening after harvest is the most important factor affecting composition and flavor of juice obtained from Delicious apples.

In a comparative study of "Fancy-Extra Fancy" and "C" grades, the principal difference in composition was a consistently higher sugar content in juices from the former grade—an average of 0.69 percent more total sugars and 0.21 percent more reducing sugars. Triangle taste tests showed the Fancy-Extra Fancy juice to be sweeter, and to have more pronounced apple flavor, while C grade juice was more astringent.

Ripening after harvest resulted in marked increase in total and reducing sugars and corresponding loss of

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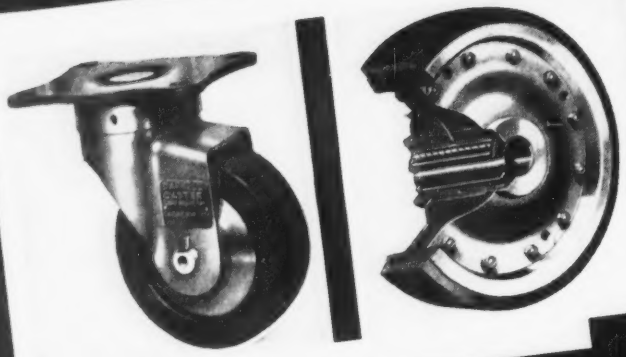

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starch, particularly during the first two weeks. There was also a slight loss in acidity. Change in flavor was pronounced. The taste panel was unanimous in discriminating between juices prepared one day after harvest and those prepared after two weeks of ripening.

Greater maturity at harvest was advantageous to juice quality. Increased maturity, within commercial range, resulted in increased apple flavor and sweetness and decreased astringency.

Juices from cold storage apples were different from those from unstored fruit, but equally as acceptable. The slow ripening during cold storage was favorable to the development of flavor and sweetness.

Digest from "Juice Quality of Delicious Apples as Affected by Method of Fruit Handling," by A. M. Neubert, G. H. Carter, J. L. Henry, J. E. Brekke, and D. W. Graham; and A. Van Doren and R. M. Bullock, *Food Technology*, 324-29, Aug., 1953.

SANITATION

Egg Shell Determinations

Quality of shells is so intimately connected with infection and rotting of eggs, as well as with cracking and breakage during transport, that studies of shell composition and structure are of considerable practical importance.

Egg shell protein is made up of matrix-protein closely associated with minerals, pore-protein, and the surface cuticle. These proteins dissolve in boiling NaOH at different rates, and shells treated in this way yield figures which approximate the proportions of the three protein types. Membrane-protein averages 5.35, pore-protein 0.78, and matrix-protein 0.79 percent, respectively, of true shell by this method.

In addition to protein content and distribution, number of pores and their distribution has a bearing on the shell behavior and susceptibility to damage. Pores can be readily seen with a microscope and counted, as well-formed, almost circular holes, if the shell pieces are immersed in concentrated HNO_3 for 20-25 sec. The method checks counts obtained by staining the shell with crystal violet both as to numbers and locations of the pores. Counts on hen-eggs ranged from 101-237 per sq. cm. or 7,000-18,000 per whole shell.

Counts per sq. mm. on a large number of fragments (320 and 640) from two different shells indicate that the distribution of pores in an egg shell is not random. Pore counting and protein distribution methods permit comparison of eggs with respect to shell qualities when they are produced

by different breeds or species of poultry, or under different nutritional conditions.

Digest from "Studies on Egg Shells. I. The Determination of Membrane-, Pore- and Matrix-Protein," by C. Tyler and F. H. Geake, *Journal of the Science of Food and Agriculture*, Vol. 4, No. 6, 261-66, June 1953, and "II. A Method for Marking and Counting Pores," by C. Tyler, *ibid*, 266-72.

Irradiation of Egg Magma Destroys *Salmonella*

Cathode-ray irradiation at the proper level will completely destroy *Salmonella* organisms in heavily inoculated whole-egg magma.

This is an important discovery in view of the fact that dried egg powders may contain viable bacteria of the *Salmonella* group which have been suspected of causing outbreaks of *Salmonella* infection in human consumers.

Results of an investigation showed that different species of *Salmonella* require different levels of irradiation for complete destruction, and that a level of 300,000 rep is required to assure destruction of all *Salmonella* in whole egg magma at high levels of contamination.

However, irradiation at 300,000 rep causes off-flavors that are noticeable in scrambled eggs. The flavor is practically removed, however, by spray-drying, so that it is not noticeable in scrambled eggs from dried magma that has been irradiated. Likewise, sponge cakes made from irradiated eggs were comparable in volume, texture, and organoleptic qualities with those made from non-irradiated samples.

Digest from "Elimination of *Salmonella* in Whole Egg Powder by Cathode Ray Irradiation of Egg Magma Prior to Drying," by B. E. Proctor, R. P. Joslin, J. T. R. Nickerson, and E. E. Lockhart, *Food Technology*, Vol. 7, 291-96, July 1953.

FISH

Chilled Sea Water vs. Ice For Transporting Fish

Preliminary experiments indicate that chilled sea water is superior to ice as a method of preserving fish from the time they are caught until the boat reaches port.

In addition to improvements in quality of fish, the following advantages are seen for the system: (1) Tanks can replace fish pens in conventional fish-hold construction; (2) they can be installed in wooden vessels without insulating hulls; and (3) no ice need be carried or handled.

In experiments, sea water tanks, refrigerated with F-12 by means of (1) Eutectic plates, and (2) coils,

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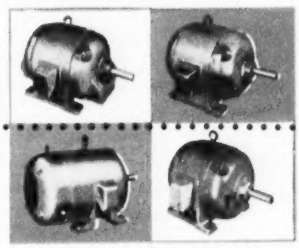

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were installed in a commercial troller. Fish were dressed as soon as caught, rinsed and transferred immediately to tanks. Controls were iced and stored in the refrigerated hold.

Upon reaching port fish from tanks and hold were compared organoleptically. The plump, wholesome, fresh-looking fish from sea water tanks could scarcely be distinguished from fresh caught ones. Skin was without bruises produced by icing. Scales were still irridescent. There was some leaching of color on inside surfaces of first lot. This was overcome in subsequent trips by addition of 200 ppm. $NaNO_2$ to tank water.

In one test with fish that had been stored for 19 days in refrigerated sea water, 96 percent of the tasters preferred them to ones stored in ice. This indicates that, as the storage period lengthens, preference for fish from sea water increases.

Digest from "Use of Chilled Sea Water in Place of Ice in Transporting Fish," *Progress Report No. 95*, Fisheries Research Board of Canada, Vancouver 2, B.C. 39:44, July 1953.

PACKAGING

Novel Mechanical Method Of Vacuum Packaging

Vacuum packaging without benefit of a vacuum chamber, or without a vacuum nozzle or tube inserted into the package, is disclosed in recent patent specifications.

According to the method, the container is evacuated in the atmosphere, using the container itself as the vacuum chamber. Packaging material is preferably a thermoplastic moisture-proof sheet.

The commodity, cheese, for example, is enveloped in a sheet and has its side margin on each end of the package folded and heat-sealed. The sheet is further folded so that the upper marginal areas can be heat-sealed across the entire top surface of the package.

This folding and sealing results in formation of ears at each end of the package in which are openings, leading to the interior. But for these openings the package is completely sealed.

Ears of the package are then clamped between jaws, and vacuum is applied to hold open a channel to the interior while vacuum is simultaneously applied to evacuate air and gases from the package. Package is then heat-sealed and removed from the machine. A single vacuum source may be used for both separating the plies of the package and evacuating the interior. Separate vacuum sources may be used, however, the higher to

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hold open the plies of material in the ears of the container, and the lower to remove air and gases from the package.

Digest from U. S. Patent 2,634,562, issued Apr. 14, 1953, on an application dated Sept. 19, 1947, to W. G. Mueller, F. H. Cherepow, and A. Bartes, Jr., Neenah, and K. Klause, Appleton, Wis., assigned to Marathon Corp., Rothschild, Wis.

BREWING

Continuous Drying of Hops

Apparatus for continuous drying of hops, recently patented, is claimed to not only yield a superior product, but also overcome drawbacks inherent in the batch method employing a house-like structure.

According to the present invention, hops are conveyed through a tunnel housing between superimposed conveyor belts made of perforated flexible metal. Conditioned air from a heater is blown upward through the hops in such volume and velocity as to support the bed between the belts and keep it loose and porous. Tunnel is divided into two or more zones, preferably two, designed to receive drying air at different temperatures.

Hops fresh from the field or frozen from the refrigerator are treated with equally good results. For frozen hops belts are adjusted to form a bed 5 in. deep. When operating on field hops, depth of bed can be increased to 30 in.

In the first drying zone temperature of air may range from 120-180 F., but is preferably of the order of 160 deg. Relative humidity is 10-17 percent. In the second zone temperature is about 20 deg. lower. Air is forced through the bed at 200-500 ft. per min., being in contact with the hops for 0.05-0.5 sec.

Advantages of the process over other methods: Close temperature control, more efficient application of heat, uniformity of product, substantial reduction of fines, no waste due to charring.

Digest from U. S. Patent 2,634,117, issued Apr. 7, 1953, on an application dated Jan. 28, 1950, to V. A. Bloxham, Berkeley, Calif.

Economical Filtration Of Hops and Trub

A number of advantages are claimed for the Fehrmann system of filtering wort following boiling. Among them are: Sterility is retained from kettle to starting cellar; aeration is controlled; heat recovery is possible; floor space is saved; less hops are required, and the spent hops are easily disposed of with little loss of extract.

In the process, hops are shredded to ⅛-in. size prior to adding to the

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In Keeping Up With Field . . . . page 253

kettle. After boiling in the usual way, wort from kettle is pumped through the Fehrmann filter, a vertical cylindrical tank with conical bottom and closed flat cover.

Vertical filter frames are placed in the tank and below them a horizontal sieve or strainer just over the conical bottom. For filtering 105 bbl. of wort, the vessel used holds 9 bbl. and will handle 44-88 lb. of hops. Total filtration area is about 204 sq. ft. so that each square foot passes 5-6 bbl. wort.

During filtration trub and fine hop particles are removed by the vertical frames while coarser hop fragments settle on the horizontal screen. Hot wort is pumped through coolers to starting tubs.

Wort remaining in filter is forced out by compressed air. Filter is opened, and hop residues removed, or contents may be flushed into the lauter tub with the next mash and disposed of along with the spent grains.

Actual trials of the process in breweries gave slightly better extract yields than control worts, and beers of high quality similar to those from worts treated in the normal fashion. The saving of 10-12 percent in hops was confirmed and there was considerable saving in time, the wort being in the fermentation cellar two hours after striking the kettle.

Digest from "The Cooling and Clarification of Beer Worts With Special Reference to the Filtration of Hops and Trub by the Fehrmann Methods," (a 5 part article) by Franz Heilmeier and Hermann Fink. *Brauwelt*, 281-85, March 20; 313-15, March 27; 337-39, April 3, 1953; 361-63, April 10; 387-89, April 17, 1953.

MISCELLANEOUS

Deoxygenase Enzyme System Removes Sugars, Oxygen

An enzyme system containing glucose oxidase and catalase has been suggested for removal of either glucose or oxygen from food products, and it has been applied successfully in the desugaring of egg white.

Overall effect is conversion of glucose to glutonic acid by molecular oxygen in the presence of the enzyme. The hydrogen peroxide formed is broken down to yield molecular oxygen which is available for oxidation of more glucose. The bactericidal activity of the enzyme is due to the peroxide formation. Processing of beer with deoxygenase is an example

of the use of the enzyme for the removal of oxygen. Processing of egg white is a good example of its use for removal of glucose.

In a commercial run, 4,000 lb. liquid egg white at 79-80 F. was adjusted to pH 7.3 with 5 percent HCl. Deoxygenase was added at the rate of 1 lb. per 2,000 lb. egg white, and H_2O_2 at the rate of 4.6 lb. per 1,000 lb. egg white. Processing time required to reduce sugar level to about 0.1 percent glucose was about 15 hr. Before drying, pH was 6.4. Treated egg white was then dried by both spray and tray drying techniques. Product was uniform in quality and free from off odors.

Other investigators have studied whipping properties of dried albumen from which sugar has been removed by the enzyme process. They found that the treated albumen rehydrated readily and was free from objectionable odor or flavor. Angel cakes made with the rehydrated albumen and 0.23g. cream of tartar in the formula compared favorably in volume and texture with control cakes made with frozen egg white and 0.90g. cream of tartar in the formula.

Digest from "The Use of Glucose Oxidase in the Processing of Foods with Special Emphasis on the Desugaring of Egg White," by R. R. Baldwin, H. A. Campbell, R. Thiessen, Jr., and G. J. Lorant, *Food Technology*, Vol. 7, 275-82, July 1953; and "Effect of Removal of Glucose by Enzyme Treatment on the Whipping Properties of Dried Albumen," by A. F. Carlin and J. C. Ayres, IBID, 268-70.

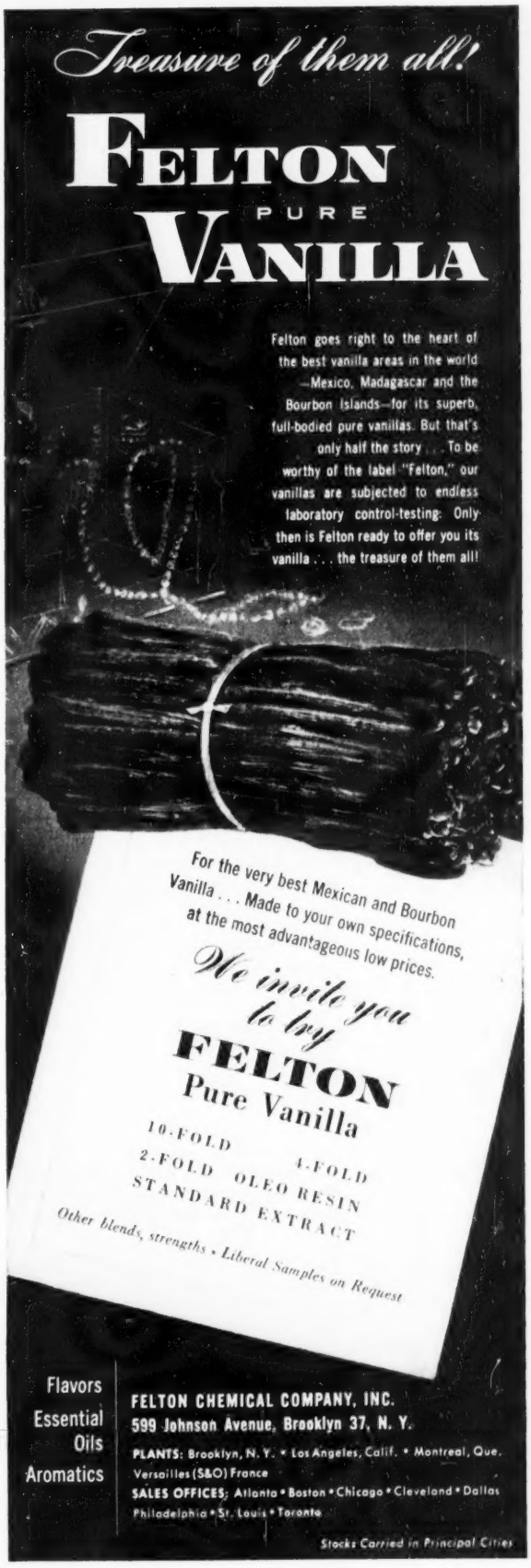
Evaluation of Sugars

Sucrose is the most acceptable sugar, maltose the least acceptable; fructose is the sweetest sugar, lactose the least sweet, according to results obtained on sugar solutions, using an untrained tasting panel of teachers and students in a college Household Arts department.

Most acceptable sucrose concentrations were 20-35 percent; under 15 and over 40 percent were not popular. Fructose was judged about 5 percent sweeter than sucrose, lactose about 10 percent less sweet.

When flavors were added, higher concentrations of sugar became acceptable and even preferred. Equal concentrations of lemon and orange oils in sugar solutions of differing strengths seemed more marked in flavor in weaker sugar solutions. Small amounts of salt in flavored sugar solutions make both flavor and sweetness seem stronger than they actually are, and sometimes improved acceptability as well. More salt is preferred in stronger flavored solutions.

Digest from "Flavour Assessment of Sugar Solutions," by Gweneth M. Chappell, *Journal of the Science of Food & Agriculture*, 346-50, July 1953.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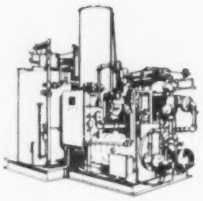

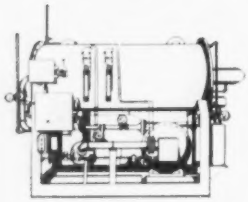

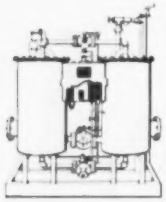

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Origin of Sarcina

Infection by beer "sarcina" is one of the most dreaded calamities of brewery operation. Fortunately it is rare, but cocci in single, diplococcus, or typical tetrad form are found in brewery yeast often enough to keep the problem alive.

Origin of sarcina has never been definitely established, though air, water, malt dust, and other foreign particles, especially those from stables, have all been suspected. It has never been proved that they originate outside the brewery, and the startling proposal is now made that the sarcina have their origin in yeast cells themselves!

Using elaborate precautions to prevent external infections, and to preserve purity of cultures, 5 races of *Saccharomyces cerevisiae* were propagated in hopped beer wort at 27-28 C. After 8 weeks, cocal forms appeared from which typical tetrad cultures were developed that were morphologically and physiologically similar to the "sarcina" found in beer.

Three strains of cocci were obtained which resembled beer sarcina in their differential sugar utilization, and in fermenting glucose to lactic acid and diacetyl.

Yeast cocci do differ from beer sarcina in their temperature characteristics, however, and are stimulated to rapid growth by temperatures around 28 C., while beer sarcina grow best at lower temperatures. Growth of only one strain of cocci was obtained on beer, but even beer sarcina are notoriously difficult to grow. If this origin of sarcina proves to be correct, long storage of yeast must be avoided, and only yeasts having small tendency to the degenerative coccal formation should be selected. Yeasts showing even a few diplococci or tetrads should not be used, and eventually yeasts may have to be tested regularly for their coccus-forming potential as part of the routine plant control measures.

Digest from "The Origination of Tetrad Forming Cocci From Yeast Cells", by W. Kleber and U. Hoffman (Wissenschaftliche Station fur Brauerei, München), *Brauwissenschaft*, 167-14, July 1953.

—*End*—

Separating

—*Continued from page 153*

First application of this unit to food processing is in the new filtration-extraction process for cottonseed. Here, strong miscella (25-35% oil) is separated from cottonseed meal, the meal

subjected to counter current washing with hexane, then discharged continuously.

Sorting

Many improvements have been made in design and operation of screens. As an example, purifiers for removing small particle of bran from middlings by a combination of screening and aspiration, were built almost entirely of wood in 1928 and contained only one sieve. Then in 1945, the number of sieves was increased. The improvement enabled one unit to do the work of two or three of the older models, and increased the yield of semolina. An even greater contribution was the saving of floor space by the shortened flow diagram made possible with this unit.

In 1950, new all-metal purifiers of sanitary design were introduced, thus breaking away from the wooden construction that had previously characterized all milling machinery.

In 1951, an all-metal circle sifter was introduced, combining three outstanding developments: (1) Use of pure gyratory screening motion in a compact unit; (2) multiple sieve arrangement for varying production capacities, and (3) modern design to meet stringent sanitary standards.

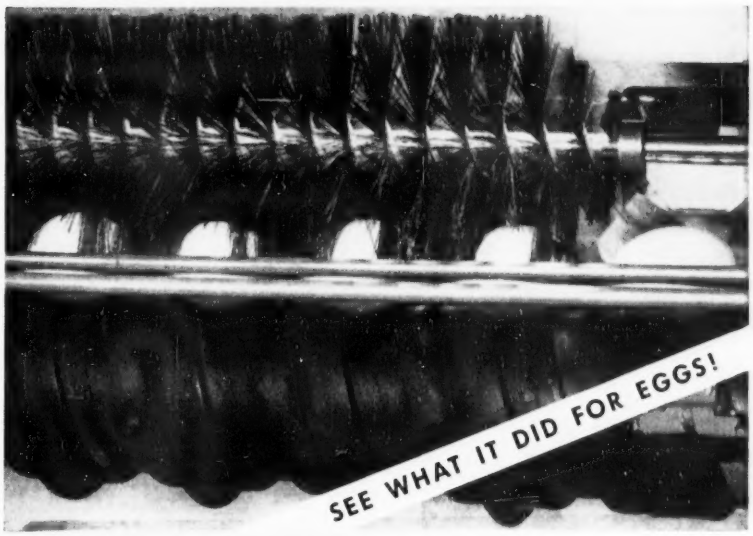
In addition to milling, this unit has found wide applications in the baking, brewing, confectionery, sugar, and spice fields.

The suspended sifter now is direct driven, the drive formerly being mounted on a pedestal on the floor below the sifter. Throw can now be adjusted without adding or removing weights. Consideration has been given to improved sanitation.

Since the introduction of vibrating and gyrating metal screens about 1933 for separation of wastes from cannery waters, steady improvements have been made in design and construction. Particular emphasis during the last few years has been placed on sanitary design by use of welded pipe framing and elimination of ledges and pockets that cause buildup of materials.

Separation by Sizes

When cylindrical screens came along in the early '30's they soon replaced flat screens for size grading and washing of fruits and vegetables. Then the cloverleaf reel for grading peas was introduced in the late '30's. Diameter of this reel (36-in.) was only a little more than half that of previous units, yet its capacity was approximately the same. Reel is made in the shape of a cloverleaf and rotates at slow speed—6-8 rpm. In this way, peas come to a



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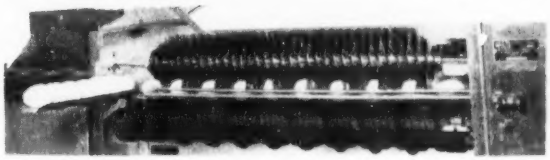

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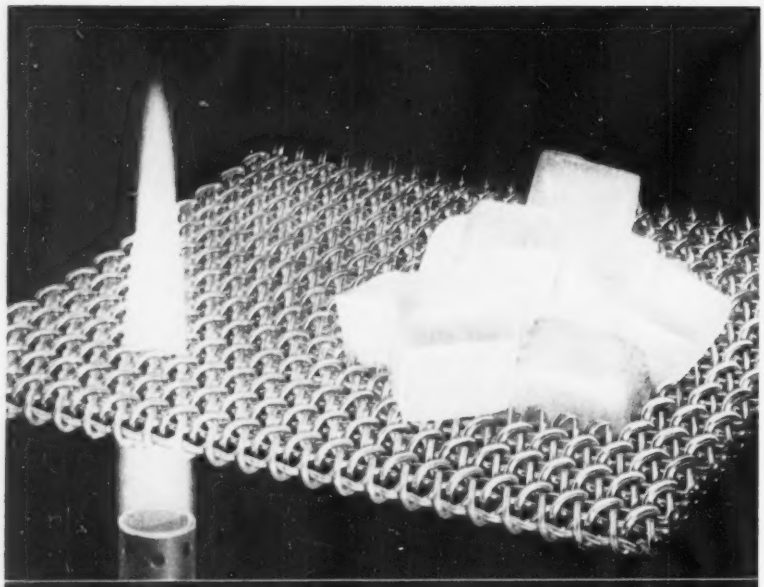

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stop four times per revolution and are brought gently in contact with surface of the reel.

The hydro principle is applied to another size grader which comprises 1-5 independently driven, revolving sieves, each with different size perforations. In operation, peas or lima beans are conveyed to largest mesh sieve by a stream of water. Here, all but the largest ones pass through perforations and are conveyed to next sieve. Number of sieves determines number of grades.

An improved shaker unit for peas, first used in 1952, is reported to have the following advantages over cylindrical screens: It requires less than 1/5th the floor space for an equal capacity; practically eliminates crushing of peas; takes less than 10% the cleaning time; is easily adapted to any number of screen sizes; and is simply installed and portable.

Four screens (one above the other) are vibrated by small motor and eccentric cams.

An entirely new operational principle was applied to cylindrical grading with introduction early this year of a roll-over unit for tomatoes and other products. Employed is a revolving cylinder of desired mesh onto which tomatoes are fed continuously. Fruit is picked up on upward arc, rolls of its own momentum on downward arc. Desired size falls through openings into trough that discharges to conveyor or processing. Oversize fruit is discharged on hopper.

Density Separations

"Dry table" separation of hulls and stones from grains, nuts, and seeds is a postwar development. It consists of an inclined, perforated oscillating table through which air is blown continuously. Motion of table tends to move particles toward upper end. However, the air fluidizes less dense particles, causing them to move by gravity to lower end of screen. Heavier particles are separated according to weight as they move upward on the screen, stones move off upper end.

Aspiration originally was tied to screening operations to remove light weight materials. Of late, however, units that depend entirely on air currents have become increasingly popular. In 1948 a new air cleaner for removing dust and lighter materials from grains was introduced. A fast air stream carries the grain past an adjustable deflector and into an aspiration chamber of larger cross section. Air velocity drops, allowing heavier particles to fall beyond the deflector, where they meet a secondary air stream before they drop to the outlet spout. Lighter particles are carried to a

larger settling chamber, where they separate from the air stream and drop to an outlet port.

Installation of this unit in a new corn milling plant in 1952 has eliminated several conventional screenings of the corn entering processing, thus saving floor space and height.

A somewhat similar unit, developed in '48, for removal of skins, leaves, stems, and pod fragments from fresh vegetables, has reduced inspection personnel by more than 50% in a large lima bean and pea freezing plant.

Closely associated with aspiration are cyclone, or bag dust collectors. An improved collector introduced in 1948 employs a reverse air jet ring that travels up and down each bag continuously. This eliminates shut downs for shaking.

In the early 30's, quality separation by flotation was made. And improvements have continued through the years. In 1949, an air-operated unit cut specifies gravity variation to 1 deg., and recently this went to ½ deg.

New applications for quality graders include the removal of pods, skins and stems from peas and lima beans following blanching. One such installation, made in 1950, reduced inspectors per table from 14 to 7.

Froth flotation—oil-in-water emulsion containing small air bubbles—was employed in 1944 for removal of extraneous matter from peas. It was effective in separating weed seeds of specific gravities near that of peas.

Another flotation process, specially developed to recover small pieces of edible walnut meats, was developed about the same time. Key to the process is a method employed to alter the specific gravities (initially very similar) of the three components, good meats, poor meats, and shells—and thus enable "buoying off" of the good meats with the aid of the floatant solution. Basically, it involves drawing air from siftings in vacuum tanks, adding water to submerge the materials, then separating good meats from waste.

An addition application has been to peeling of wheat in the milling field. Following the usual rough cleaning, wheat is conducted through ten flotation cells, each equipped with rubber covered impellers. Kernels are vigorously agitated and thrown against sides of the cells to loosen hulls, which float in the froth as the kernels sink to bottom and are removed.

Color Sorting

In 1931, automatic, 10-per-sec. color sorters for pea beans were installed in a Michigan plant, eliminating a number of inspectors. By 1940 capacity had climbed to 60 per sec., and the

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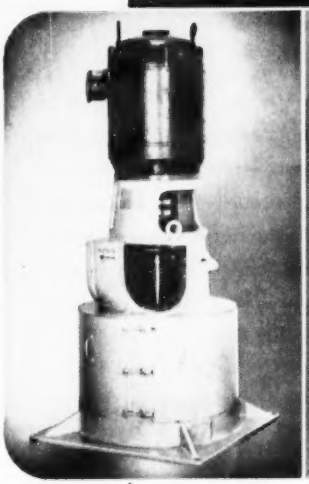

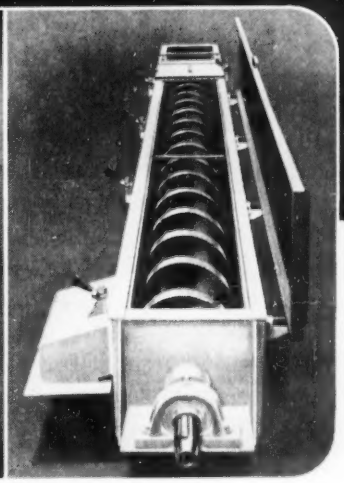

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number of products sorted had increased greatly. Present units sort small grains, seed corn, peas, garden and commercial beans, nuts, dehydrated potato cubes, and green coffee. Capacities range from 20 per sec. on large nuts to as high as 1,500 per sec. on small seeds. A new unit for larger size objects primarily for lemons was introduced in 1952. It will handle products from 1½-4 in. dia.

One recent installation employs a battery of 150 machines for sorting almonds (plus 20 for re-sorting rejects). This has eliminated 200 workers, handles 21 tons of nuts per 8-hr. day. Performance of initial sorters is 99%. Of the rejects, 10-15% are reclaimed by the re-sorters.

Electrostatic and Magnetic

A recently developed electrostatic separator involves an integrated movement of grain over several grounded conveying rolls and past electrodes charged to 30,000v. Corn and impurities are separated—their differing electrical charges deflecting them into separate bins. Extraneous matter is reduced to an almost undetectable level compared to 90% removal by previous method.

Electromagnet separators of various designs were used in the grain and meat branches of the industry as far back as 1928. Then in the early '30's a simple permanent-magnet separator was developed.

These units remove iron objects from raw material or product streams. They are available for use on liquid, granular, or viscous materials. Designs include plates, pulleys, drums disks, grates, and traps.

Extraction

Solvent extraction (which reduces oil content of meal to less than 1%) was applied to soybeans in the late '30's. Today, more than 50% of all soybeans in this country are extracted by this method.

Solvent extraction is almost entirely automatic, resulting in low labor costs. However, cottonseeds and peanuts are inclined to disintegrate under influence of solvents and impede uniform circulation through the mass. So solvent extraction was not applied to cottonseeds until '46. But great strides have been made since. Two new processes evolved this year that greatly reduce initial investment, making them applicable to mills handling as little as 75 tons daily. Additional advantages are: Less solvent required, and elimination, to a great extent, of the fines problem.

Accepted methods for separating juices from such products as apples,

For more information, use coupon on page 207.

grapes, tomatoes, citrus fruits, and pineapples 25 years ago were comminuting or grinding and/or pressing, pulping, and finishing.

A screw press line of extractors and finishers for tomatoes was introduced in 1934, increased yields. Larger capacities, and more sanitary construction are other improvements.

A citrus juice machine, patented in 1932 but never built, comprised two belts moving in opposite directions, carrying specially designed cups that close tightly on fruit when they pass a meeting place. Cups grip fruit firmly during halving and throughout extraction by two wheels.

Three years later an extractor was introduced employing substantially the above principle. It now operates at 350 per min.

Next came a juice press employing two oppositely positioned rotating cylinders having grooves that form cups (when cylinders meet). These push fruit through a cutting blade and into a second pair of cylinders. Grooves in one of these cylinders coincide with protuberances in the other to squeeze the juice from the halved fruit. This unit has high capacity—360 per min.

Another extractor consists of revolving spiked drums that carry fruit past saw-toothed halving blades. Drums then press fruit against a perforated extractor grid. Pneumatic cylinders control pressure and distance between drums, and grid can be varied according to size of fruit and amount of peel oil desired in the juice.

New Type Makes Debut

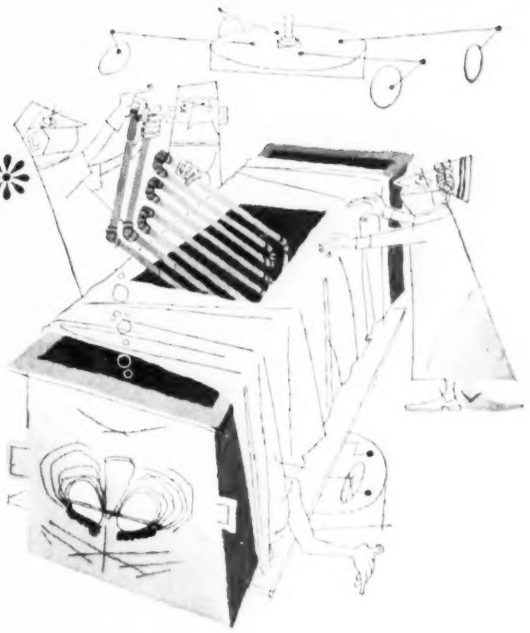
An extractor based on an entirely different principle was introduced in 1947. This machine comprises a series of cups, each having 20 curved fingers, and mounted on a circular rotating table. Another set of similar cups is mounted above. Fruit feeds from the hopper into the lower cups, after which the upper and lower fingers intermesh with a positive squeezing action. A tube with cutting edge moves upward from the lower half of the cup and removes a circular plug from the fruit through which juice flows.

Machine has a capacity of 480 fruit per min.; straight-line units employing the same principle, have capacities of 120 and 200.

In 1950, two new units for extraction of juice from pineapples were introduced—a drum-type and a screw-type extractor—which are used in tandem to enable the canner to obtain more juice than with former equipment.

End (*Resume reading on page 155*)

has **coil-itis** got you constantly doctoring your tanks?



Like the human appendix, pipe coils often give constant trouble until they are removed and replaced with Platecoils. Immediately, you will notice the difference as Platecoils put new life and profits into your heat transfer processes. They heat or cool 50% faster. They take 50% less space in the tank leaving room for greater payload. Platecoils overcome the limitations and operating difficulties of old fashioned and outmoded pipe coils to save hours of downtime.

It costs less to cure coil-itis with Platecoils than to suffer its evils.

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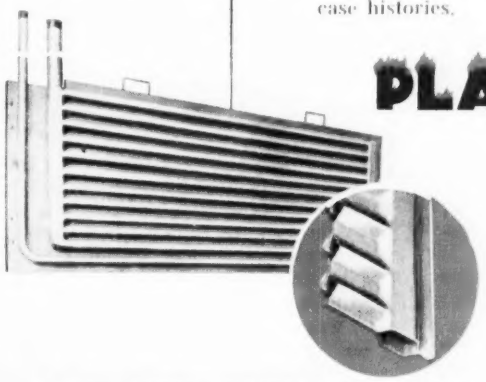
At Motor Wheel Corporation cleaning time has been cut from 10 hours per pipe coil every 60 days to only one hour per Platecoil. Ask about other case histories.



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PLATECOIL DIVISION, TRANTER MANUFACTURING, inc., LANSING 4, MICHIGAN

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Questions & Answers

THIS MONTH'S PROBLEM

Question—In making sauces, we use tomato puree (sp. gr. 1.07), water, salt, spices, and flavoring. Sauces are brought to boil or simmer for a definite period of time, depending upon consistency desired. After processing, puree separates, leaving a water solution on top of the container. A test with a half-and-half puree and water also showed separation after keeping the mixture overnight at room temperature. The same mixture put through a Waring blendor also showed separation. Is this natural for puree-water mixture? Or are we omitting some important step in sauce preparation? Could it also be the fault of the puree manufacturer since we purchase the puree rather than make it ourselves?

Answer to August Problem

The Question Was—One of our production processes involves adding a number of ingredients in succession to a kettle during cooking and mixing period. Occasionally, we lose batches due to accidental omission of some ingredient. Unfortunately, the amounts of some ingredients are so small that they hardly show up in finished batch weight, yet are of great importance from the standpoint of controlling product uniformity. How can we set up a relatively simple, inexpensive system of checking each batch to reduce errors and make the process as foolproof as possible?

Answer—Not having full details of your process, it is only possible to furnish you with general information, which we hope will be helpful.

Each process has its own peculiar set of conditions, but the general problem is usually the same—converting the addition of each ingredient into an operation or an indirect property change in the product, so that either can be measured or controlled, mechanically or electrically. For instance, weight increments might be printed on a scale attachment and then used as a control record.

A possible solution might be the use of an electric "operation recorder." In this case, it would be necessary to devise separate operations for adding each ingredient. Such operations might involve opening a valve in a supply pipe, cycling a feeder, or even manual weighing on a separate ingredient scale. Once this is done and suitable microswitches, mercury switches, or photocells are provided to indicate valve, scale, or other motions, these devices can then be hooked up to a recorder. A chart record can then be produced automatically for each batch — at a remote point, if desired.

All these electrical-mechanical signals, indicating that ingredients have been added in proper weight and sequence, could be interlocked by timers and relays at a master control station to guarantee product make-up.

Here, for example, is the sequence of a foolproof system:

Water (150 gal.) is added to a mixing vat by a preset flow meter—first step of the pushbutton process. Contact in flowmeter closes water valve and starts vibrating feed to add dry sugar for 8 sec. (using time-delay relay) according to exact formula. After 8 sec., a valve on a small supply pipe from an ingredient tank opens to admit exact amount of third ingredient on a timed basis. At the end of this time, heat can be automatically turned on and temperature controlled. When a certain end-point is reached, another addition can be automatically fed and a pH electrode can determine the end of the reaction.

For additional information, we suggest that you contact manufacturers of instruments.

However, if some property can be determined that changes with each addition, and if this change can be readily measured, then the problem is even simpler. Supposing, for example, that batch temperature is raised or lowered by the addition of each ingredient. Then a sensitive

How Would *You* Do It?

Readers are invited to submit to FOOD ENGINEERING answers to questions in this department, especially to "This Month's Problem." Selected answers will be published, with credit (unless you specify otherwise). We pay space rates.

What Is *Your* Problem?

Subscribers also are invited to send in food engineering questions. We undertake to provide answers, free, to the best of our ability. We do not undertake costly investigations. Give full information and your name. Your identity will not be disclosed.

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- Prepared Brownie Mix
- Barbecued Beef Dinner
- Frozen Meals
- Pre-cooked Snack Tray
- Brown 'N Serve Sausage
- Upside Down Cake

- Peanut Spread
- Deep Dish Apple Cobbler
- Beef Pot Pie
- Macaroni Salad
- Premium Lard
- Frozen Fried Shrimp
- Potato Salad
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- Hamburger Loaf
- Family Fudge Block
- Coffee Bread Mix
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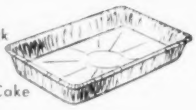
- Cheese Blintzes
- French Fried Potatoes
- Frozen Potato Puffs



- Frozen Chicken Pie
- Frozen Meat Pies
- Frozen Fruit Pies
- Roast Beef and Gravy

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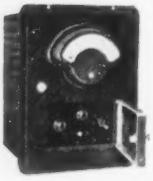

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thermometer bulb can be inserted into the kettle and connected to a recording chart, which will record successive "humps" in temperature curve. Each hump will then be a record of an ingredient addition.

Let's assume that batch viscosity is similarly affected. A recording ammeter can then be installed in the agitator-motor circuit.

Perhaps the solution may involve checking changes in pH or conductivity. In either case, a recording meter hooked to a glass electrode or conductivity cell may serve the purpose.

Most likely, though, the final solution may require a combination of measurements, since different amounts of ingredients are added. Some ingredients may be readily checked by scale readings. Others may be more easily detected by their effect upon some other property.—*The Editors.*

More on Problem

A relatively simple, inexpensive way of possibly eliminating the addition of ingredients to be introduced in small amounts to a batch process would be to employ a pilot-light system.

If a battery of toggle switches, each designated to control one ingredient, were wired to a parallel control of a pilot, an operator could turn off the appropriate switch each time an ingredient was added. The warning signal, however, would stay on until all ingredients were introduced.

Variations of this scheme would permit selection of only certain ingredients for this type of control, as well as the use of switches in series to prevent the next part of the cycle from starting up until all switches were closed.

It is realized that this proposal does not omit the human element. But it would be possible for a responsible operator to eliminate the careless lapses that would otherwise occur, even though gross negligence could still cause trouble.—*Hugh Parkhurst, Gorton-Pew Fisheries Co., Ltd., Gloucester, Mass.*

Still More

In your August problem, it is noted that omitted ingredients are usually small in amount. In this event, we'd like to point out that a number of food processors have solved this problem by packaging these ingredients in a single bag.

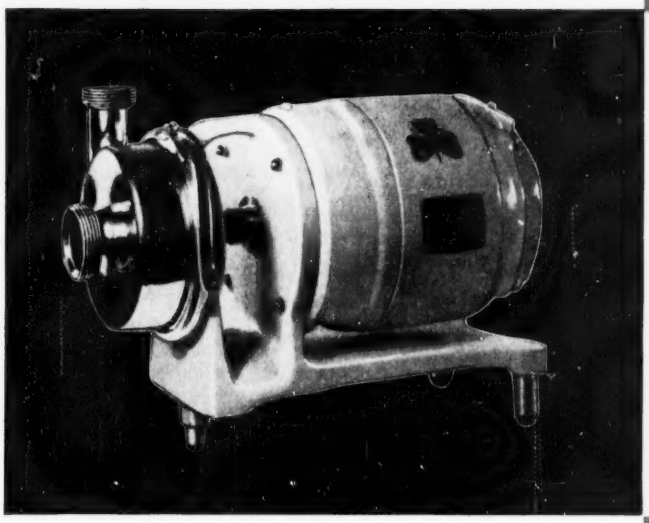
This, of course, is possible if all ingredients are compatible and if they can be introduced at one time into the batch.

If, on the other hand, they can-

You'll find all the features you want in TRI-CLOVER PUMPS

"Standard" Sanitary Series

Designed for the non-agitating, efficient pumping of milk, food products such as diced carrots, cream style corn, tomatoes, applesauce, relish and beverages. It is also practical in breweries and for the pumping of drugs and chemicals in solution.



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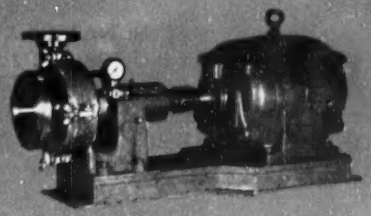

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not be added at one time, then look into the possibility of making a multiple package. Such a package would consist of a large bag containing the bulk of the minor ingredients. Within this bag would be one or more small ones containing those ingredients to be added in even smaller amounts.

For example, you might have a large bag with a mixture of salt, sugar, and meat-curing material. Inside this bag, there might also be a smaller one containing spices. Other combinations of ingredients can similarly be made.

After these ingredients are introduced into the batch, empty bags will be in plain sight of attendant.

As a further safeguard, detachable numbered tags could be affixed to bags so that they could be torn off after being emptied and then turned into a foreman or superintendent.—*F. W. Griffith, The Griffith Laboratories, Inc., Chicago.*

Suggests Single Instrument

Checking the addition of a number of ingredients to a kettle during cooking and mixing can be simply and inexpensively carried out with a single instrument—a multi-pen, operation-time recorder.

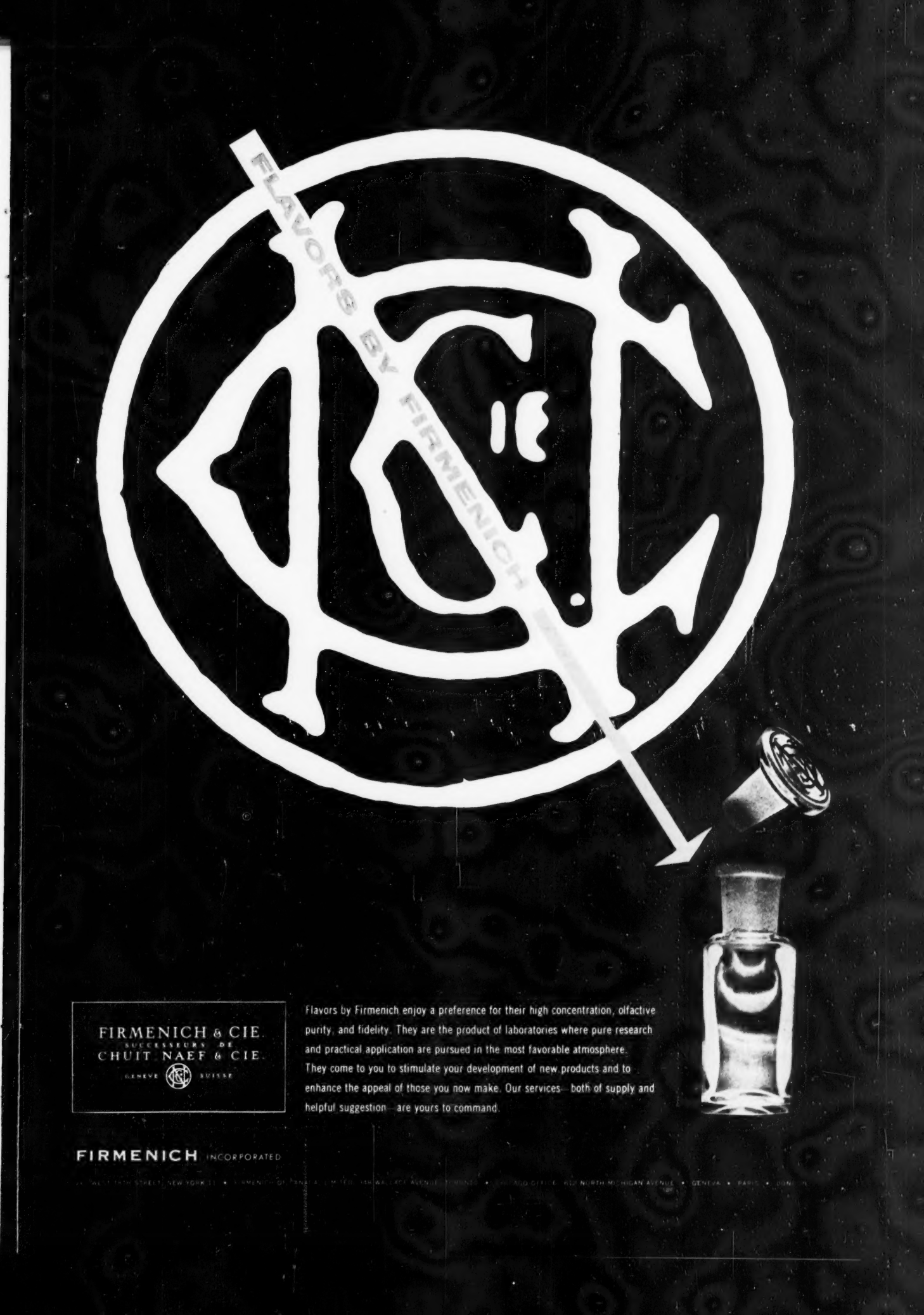
Ingredients can be measured and held in suitable bins and then introduced into the kettle. To feed each ingredient into the kettle, an operator merely pushes a button that opens a valve on each bin. As each valve opens, a switch automatically completes an electric circuit to the recording pen in the operation-time instrument. The pen then deflects from its continuous record on the chart.

Each ingredient can be thus recorded by a separate pen and with different ink color. In this way, a single instrument can record as many as eight different ingredients. The record on the chart will thus provide printed proof that each batch contains the necessary ingredients.

Several improvements can be incorporated into this system. For instance, signal lights at the central-weighing station can be installed to inform an operator when ingredients have been scaled into holding bins, ready for delivery into the cooking kettle.—*L. M. Richardson, Food Industries Division, The Foxboro Co., Foxboro, Mass.*

Wants Info on New Fats

Question—*What information do you have on new fats recently developed by government researchers? We've been told that these fats can be used to make a margarine-like prod-*



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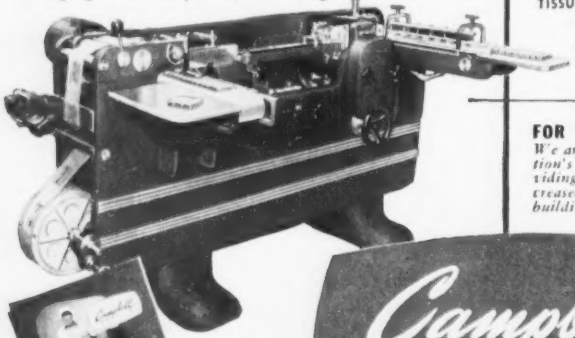

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uct that can be easily spread at temperatures below freezing and well above 100 deg. F.

Answer—Perhaps you are referring to work carried out by researchers of Southern Regional Research Laboratory, who developed the new, modified fats — aceto-oleins and acetostearins. These fats are formed through chemical substitution of acetic acid for part of the fatty acids in oleins or stearins, which occur in oils and fats.

Tests have shown that a margarine-like product containing about 79 percent of the modified fats, aceto-oleins, and about 18 percent of hydrogenated oil (cottonseed or peanut) is spreadable at temperatures between 5 and 120 deg. F. Such a spread reportedly keeps better than either butter or margarine.

A product which is spreadable within somewhat narrower temperature range can be made with 66 percent aceto-oleins and 30 percent partly hydrogenated oils. This spread is also supposed to have better mouth-eating properties.

Acetostearins have been developed which are nongreasy and highly flexible at the same temperature. And they can be tailor-made to have sharp melting points.

Q.—What are soluble oils or flavors?

A—They are mixtures usually containing one part essential oil to three or four parts of a suitable wetting agent. Reason that they are referred to as soluble oils is that they are clear when made up in an aqueous solution.

Making Pancake Flours

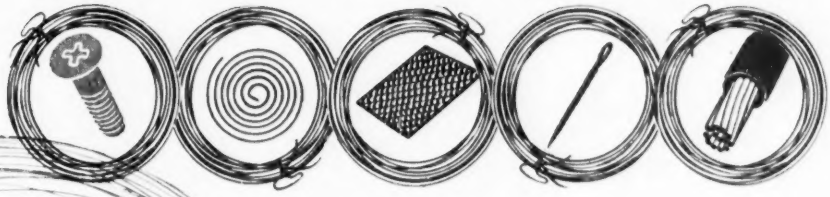
Question—We'd like several formulas for preparing pancake flour. Could you furnish us formulas with and without buckwheat flour?

Answer—Here's a formula including buckwheat flour: Buckwheat flour, 29 lb.; corn flour, 11 lb.; wheat flour, 2¼ lb.; dry skim milk, 3 lb.; phosphate, 1¼ lb.; bicarbonate of soda, 1 lb.; and salt, 1 lb.

And here's one without buckwheat flour: Corn flour, 25 lb.; wheat flour, 18½ lb.; rice flour, 4¾ lb.; phosphate, 1¼ lb.; salt, 1 lb.; and bicarbonate of soda, 1 lb.

Air Pockets in Wieners

Question—Occasionally, we run into a little problem that has us baffled. Some of our sausage products have small air pockets—this is especially so with our frankfurters. The



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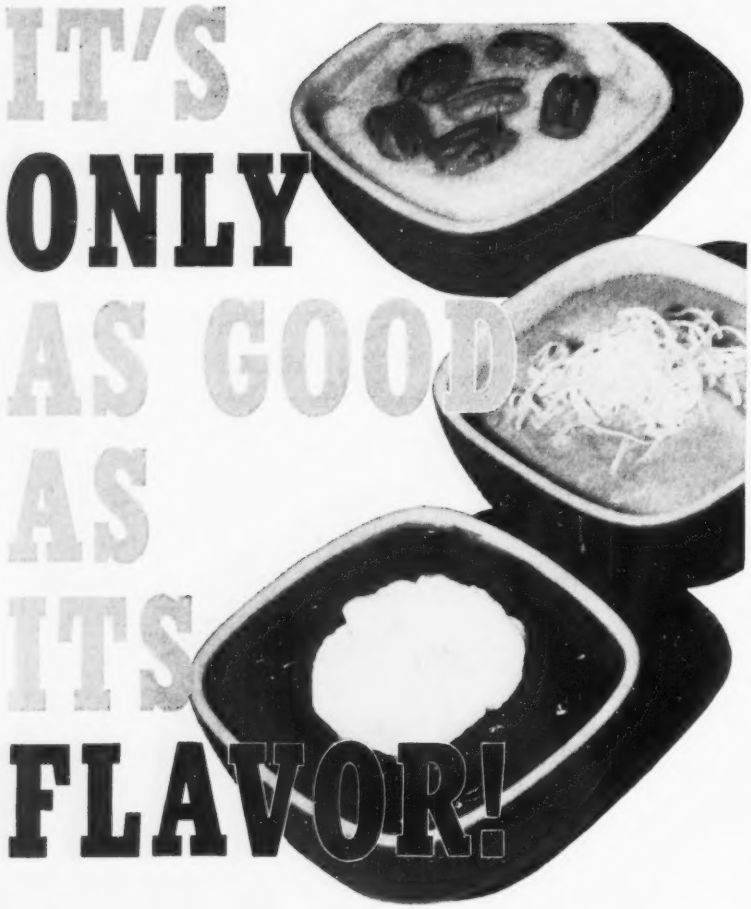

BOON that it is to busy housewives, the now popular instant puddings had to offer something more than mere easy-to-make convenience to win the continuing demand of a discriminating, hard-to-please home audience. The "something more" these products offered was GOOD FLAVOR,—vanilla, chocolate, custard, coconut, strawberry, raspberry, caramel, butterscotch— flavors that appealed and satisfied. While novelty of product gave instant puddings their initial impetus, tasty flavors kept them at their lively selling peak. Which is what good flavors can do for any food or beverage product . . . . good flavors like those produced by FRITZSCHE . . . .

A FIRST NAME IN FLAVORS SINCE 1871.

FRITZSCHE *Established* 1871 *Brothers, Inc.*

PORT AUTHORITY BUILDING, 76 NINTH AVENUE, NEW YORK 11, N. Y.

BRANCH OFFICES *and* *STOCKS: *Atlanta, Georgia, Boston, Massachusetts, *Chicago, Illinois, Cincinnati, Ohio, Cleveland, Ohio, *Los Angeles, California, Philadelphia, Pennsylvania, San Francisco, California, St. Louis, Missouri, *Toronto, Canada and *Mexico, D. F.* FACTORY: *Clifton, N. J.*

problem is particularly bad with franks stuffed in natural casing, since spoilage first takes place around the air pockets. Have you any idea of how we can avoid these air pockets?

Answer—There are two things that you should investigate. First, see if there is a leaky piston gasket inside the stuffer. If there is, then stuffer will allow air into the meat.

Second, make sure that you are properly loading your stuffer. Meat should be slowly loaded and also packed tightly into the stuffer.

Packaging Bananas

Question—Could you help us determine best method of labeling banana hands (6 to 8 fingers to a hand)? We have tried using decals, but we found this method impractical since it slowed our operations.

Answer—There are three methods of labeling banana hands—using paper-gum tape, cellophane bands, or pressure-sensitive labels.

To our knowledge, most produce houses are employing paper-gum tape, which is supplied in rolls. It is dispensed by a tape chuter that moistens the glue as tape is cut to the desired length. After the girls weigh the bananas, they apply the strip of tape to them. Weight and price of the bananas are then marked on tape with a wax pencil.

We understand that there is a trend toward use of colored cellophane bands. The 2-in. wide rolls are automatically dispensed by a Wrap-Ade sheeter-gluer, which applies a line of glue to film and cuts it to desired length. Glass-marking pencils are used to write price and weight on the bands. Overall costs—covering labor and material—are approximately the same as for the paper-gum tape method.

Q.—What mesh screen should be used for keeping flying insects from entering through windows?

A.—Use window screens of 18 to 24 mesh.

Recently, using paper-sensitive labels is proving satisfactory. Employed is an electrical dispenser that feeds labels faster than an operator can handle them. To prove satisfactory economically, a packer must receive a steady supply of at least five carloads weekly.

Experiments with transparent bags have not proved satisfactory. Cost of material and labor proved prohibitive. What's more, control had to be exercised in ripening the fruit. And they could not be held too long in bags, unless they were perforated.

It's smart to stick with Swift's Adhesives

They serve you and food shoppers, too.

Canned or bottled products that go home with shoppers should have attractive, neat appearing labels. That's why so many manufacturers look to Swift for labeling adhesives. Swift's specialized adhesives provide a lasting bond for labels on bottles, jars and cans. And more! Swift has equally effective adhesives for many other uses.

When you need adhesives, always remember—

- Swift has years of specialized experience in adhesives production.
- Swift works with a broad range of quality raw materials.
- Swift has extensive adhesives manufacturing facilities . . . distribution points from coast to coast.

Two adhesives for packaging operations

#1485 pick-up gum — handles easily on high-speed lines, doesn't stain and leaves no shiners.

#446-J lap paste and case seal — operates at high speeds, non-wrinkling and non-staining, easy to use, and doesn't loosen up under moist conditions.

The National Cranberry Association of Hanson, Massachusetts, uses Swift's #1485 pick-up gum and #446-J lap paste and case seal adhesive in their canning operations. Tight, neat labels and securely glued cases are assured.

Call **SWIFT** first for **ADHESIVES**

SWIFT & COMPANY
Adhesive Products Department
Chicago 9, Illinois

This offer expires Nov. 30, 1953

Please send your 100-lb. introductory trial shipment of:

☐ Swift's #1485 pick-up gum
☐ Swift's #446-J lap end paste and case seal

} At the quantity prices

These will be tested for use in our operations. We understand, if not fully satisfactory, they may be returned for credit at your expense.

Name _____ *Title* _____

Firm Name _____

Address _____

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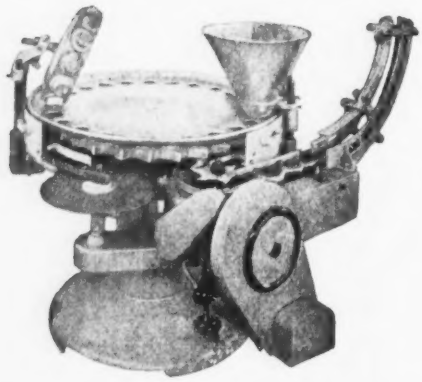
CRCO Presents the Advanced No. 650 HAND-PACK FILLER



A Semi-Automatic Filler That Gives Hand-Pack Quality Filling on Whole Tomatoes, Cut Stringless Beans, Olives, Berries, Cherries, Sliced Beets, Peach Halves, Pear Halves, Plums, Apricots, Sliced Pickles, Gherkins, Relish, Small Onions, Mushrooms and Specialties

The new 650 is an advancement over the favorite Model 600 Hand Pack Filler and embodies many of the features which have been recommended by our engineers. Among them you will find:

IMPROVED . . .

—Clutch which is easily accessible;
—Feed and discharge can ramp to reduce spillage and can damage;
—Can Hooks to prevent product lodging in internal mechanism;
—Can Track for smoother container travel;
—Lubrication for longer life;
—Covered worm drive to prevent corrosion.

Models Available for Tin and Glass

THE BEST OF Everything

CHISHOLM-RYDER CO. INC.
Niagara Falls, New York
FOR THE FOOD PROCESSOR

Chisholm-Ryder Company of Pennsylvania
AN AFFILIATE

Ayars Machine Company
A SUBSIDIARY

Product Dispensing Problem

Question—Can you furnish us with suggestions on an automatic or semi-automatic method of cutting pork into pieces and feeding them, one-by-one, into cans for our pork-and-bean pack?

Answer—The cutting problem is easy, but not the dispensing one. Various makes of machines are on the market for dicing pork into uniform pieces. But, to the best of our knowledge, no machine is available for automatically feeding one piece of pork into each can carried along on a conveyor belt.

A hopper-type vibrating system has been attempted, but without success. Because of the fatty nature of the pork, pieces stuck together. And instead of a can getting one piece, it often received two or more. Chilling the pork to prevent sticking also did not prove satisfactory, according to one packer.

We don't know if the following technique is being employed, but it might be worth looking into. Try cutting up the pork longitudinally into bars. Then have one girl place this long strip of pork on a sliding track feeding either a rotary or guillotine-type knife directly over a belt moving cans of pork in single-file. As each can makes a contact (electrical or mechanical), the knife is actuated and a piece of pork drops into the can.

You might also try a "no-pork, no-can" feeding system to enable the girl to reload the sliding track with another strip of pork. A similar, adjacent line could be set up to make the filling operation run on a continuous basis.

Maybe the solution to your problem lies in changing the nature or form of the pork by freezing it into the form of a rectangular slab. Molded slabs might then be conveyed to longitudinal and cross-cutters to form diced pieces that might be more easily dispensed in frozen form.

Have readers any suggestions?

Q.—In the July issue of FE, you had a news piece entitled, "A-Tracers Gage Cleaners in New Research Lab." Just what is meant by the word 'tracers'?

A.—When a radio isotope combines with an ordinary element, radioactive atoms become tracers. It is somewhat like tagging fish to follow their migrations. Tagged fish are not aware they are different from the rest of the school, but they can be readily identified anywhere in one of the oceans.

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Your shipping container
can double as a merchandising tool.

To produce boxes with extra sales impact, Union board machines are equipped with two headboxes instead of the customary one. You get a lighter, more attractive board color: a smoother finish; a better printing surface. And, of course, Union boxes continue among the strongest made.

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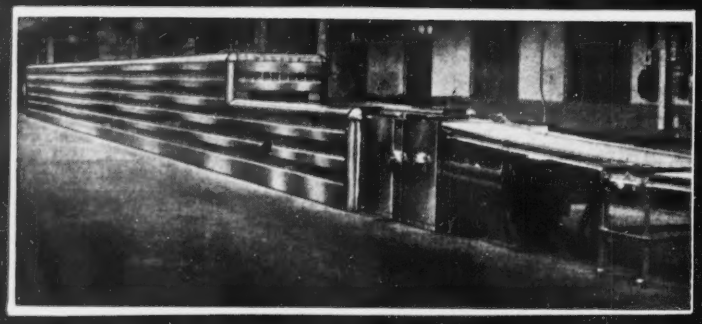

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with Advance-designed features that mean increased production at lower cost:

- Controlled Top and Bottom Recirculated Heat.
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- Conveyers of Swedish steel or wire mesh band. Chain and roller drive. Electronic self-aligning design.

✓ADVANCE REVOLVING OVENS . . .

Uniform, dependable production. Available in 12 sizes. All steel and aluminum construction with drop-type doors, safety pilots, electric ignition. Choice of stainless steel, porcelain or aluminum exteriors.

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OVEN COMPANY

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Manufactured in Canada by Fort Engineering & Sales Ltd., Montreal

Has Air Bubbles in Jellies

Question—Occasionally we run into a problem—entrapment of air in our jam and jelly packs. Have you any suggestions on how this difficulty may be overcome?

Answer—Bubbles may be attributed to fermentation brought about by faulty cooking, filling, or capping. Or, it is possible that fast setting of product may entrap air bubbles. If it's a matter of air bubbles, then use less pectin or try adding a suitable buffer salt.

Entrapment of air occuring during cooking can be avoided by drawing off product through a valve in bottom of cooking kettle. Bubbles may also appear if jelly is capped under vacuum. But this can be overcome by filling at a lower temperature—not however, below 180 deg. F.

Q.—Have you any idea how we can make it easier for our operators to read vacuum and pressure gages, especially those gages with very fine divisions?

A.—You might consider the possibility of attaching an inexpensive, magnifying reading glass to the gage connection.

Copper in Foods

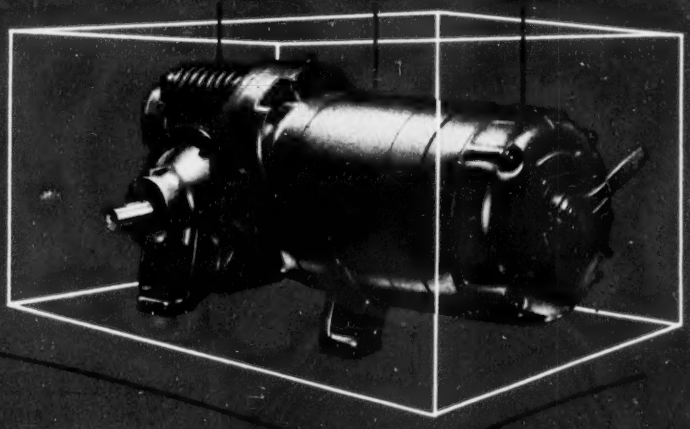
Question—Please advise me on maximum amount of copper permitted in jams and marmalades. We use copper kettles to prepare our products, and chemical analysis show presence of 0.1-0.2 mg. per kilogram.

Answer—Very little evidence has been found that copper dissolved from cooking kettles has proved harmful to humans.

The U. S. Dept. of Agriculture has established a tolerance of 30 ppm. of copper for foods. The tolerance set up by the U. S. Treasury Dept. for water is 0.2 ppm.

Regulating Liquid Flow

Question—Our problem is automatically controlling the flow of preserves to the hoppers of filling machines. Present system is very inadequate, since it requires manual regulation of the discharge valve on the holding tank. We have a float in the hopper of each filling machine for automatically cutting off the flow of product when it reaches the full-level mark. But when the float drops to the low-level mark, the operator of the filling machines must use a loud-speaker system to call for more product from tank on the floor above. Not only that, we sometimes have float-valve



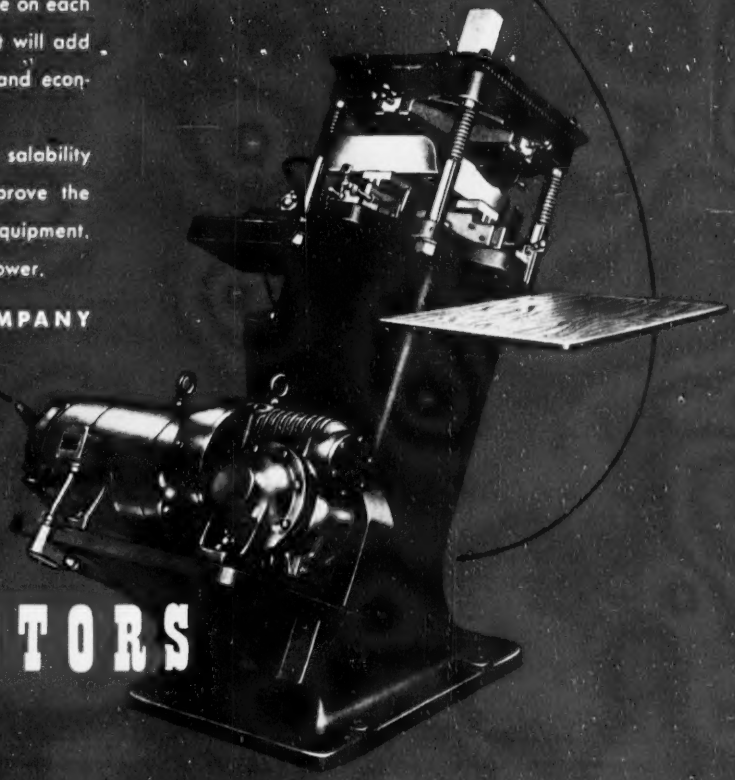
Don't put up with make-shift assemblies when it is so easy to get the RIGHT horsepower, the RIGHT shaft speed, the RIGHT construction features, the RIGHT mounting . . . all combined into one compact, easy to use power package.

All in one package

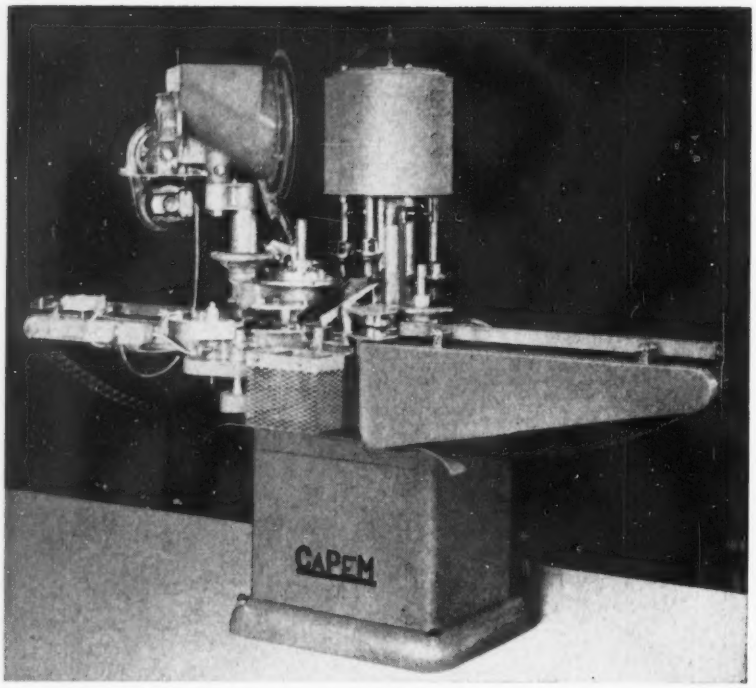
Master Gearmotors, available in thousands and thousands of combinations of types and ratings, permit you to use a power drive on each job that's just right . . . a power drive that will add greatly to the compactness, appearance, and economy of each of your applications.

Use Master Gearmotors to increase the salability of your motor-driven products . . . improve the economy and productivity of your plant equipment. They're the horsesense way to use horsepower.

THE MASTER ELECTRIC COMPANY
DAYTON 1, OHIO



MASTER GEARMOTORS



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THE MODERN SCREW CAPPER

- Applies any type of standard screw cap or cover at speeds of 2000 to 10,000 per hour.
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- Handles bottles, jars, cans or jugs of any size or shape.
- Delivers a perfect, LEAKPROOF seal at low cost.
- Available in 1, 2, 4, 6 and 8 spindle models.

Write for prices and delivery.

CONSOLIDATED PACKAGING MACHINERY CORP.
BUFFALO 13, N.Y.

failures and costly overflows. Can you offer us any suggestions?

Answer—There are several solutions to your problem. Here's a good one. Weld the float to a stainless steel tube that serves as a sleeve over a blind extension of the filling line from the holding tank. This arrangement will keep the float centered.

Now weld a collar to the sleeve and install a pivoted lever. Collar will lift the forked end of lever as sleeve rises. Put a counterweight on the lever arm to enable fork to ride down with collar as level of the product drops in filling hopper.

When product in hopper reaches low level, lever will trip a solenoid control. Air is then admitted to a cylinder operating a valve on holding tank from which the product is fed to the filling machine supply tank. The solenoid circuit is then opened when the float reaches the full-level position. The air valve is thereby closed, air is released from the actuating cylinder, and holding valve is closed by spring-tension.

Q.—Exactly what is an invert sugar?

A.—It is a mixture of dextrose and fructose (levulose) sugars, obtained by either heating a sugar solution with an acid or treating with an enzyme (invertase). The sucrose sugar combines with 5.26 percent of its weight of water and splits into equal weights of the simpler sugars, dextrose and fructose.

Commercial invert sugar is available as a colorless, viscous syrup or as semi-solid, partially crystallized material.

Spray Residue on Fruit

Question—As a small manufacturer of apple products—particularly cider—we would like to learn of a simple, inexpensive method of removing lead arsenate-spray residue from fruits. Can you also advise us what federal tolerance has been set for arsenic in apple cider?

Answer—Lead arsenate spray residue is commercially removed from fruit by immersing it for at least a minute in a 1 percent solution of hydrochloric acid. Following this treatment, the fruit is then thoroughly washed with water.

Most of the arsenic derived from sprayed apples used in making cider remains in the lees or is picked up by yeast during fermentation of the apple juice.

Limit for fruits and vegetables shipped interstate is 3.6 ppm. of arsenic.

no other ingredient
adds so much sales appeal
for so little
as *National*

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Regardless of season or climate, National Certified Food Colors assure uniformly-appetizing color in your finished goods. An appetizing color is the greatest single spur to sales.

Products of exceptionally close chemical control, the pure-dye percentage in National Certified Food Colors is held within remarkably close limits batch after batch. So that once you establish a color formula, you can be sure the same formula will produce the same shade again and again.

Fine foods deserve fine colors. For the finest, specify "National".

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There are ways of increasing efficiency without building a new plant.

Take the LIXATE Process for making brine automatically, for instance.

A simple installation cuts handling and labor costs, delivers pure, constant, 100%-saturated brine to any point in your plant at the twist of a wrist. You use economical rock salt – and gravity does all the work – automatically, instantly.

The LIXATE Process is adaptable to your particular requirements. Write, and our representative will show you how.
No cost, no obligation.

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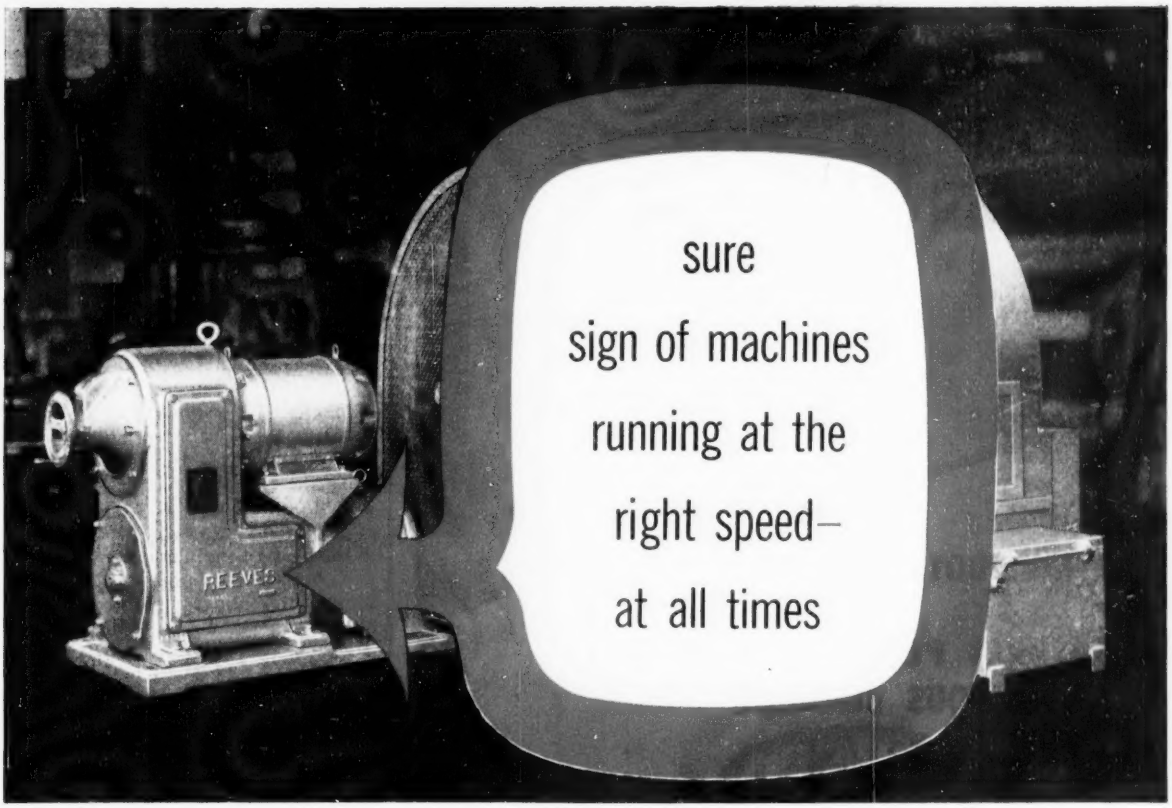

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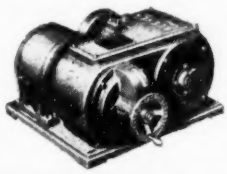
VARIABLE SPEED TRANSMISSION: Provides stepless speed adjustability over a wide range—as high as 16 to 1; sizes to 87 hp. Vertical or horizontal designs—open or enclosed.

VARI-SPEED MOTOR PULLEY: Converts any standard, constant-speed motor to a variable speed drive. Speed variations up to 4 to 1. Sizes to 10 hp.



VARI-SPEED MOTODRIVE®: A complete variable speed power plant. Combines any standard, constant-speed motor, REEVES speed-changing mechanism and gear reducer in one, compact unit. Sizes to 30 hp; speed ratios as great as 10 to 1.

Machines equipped with REEVES Variable Speed Drives . . . have a wider work range, handle more different shapes, sizes, and materials . . . because REEVES *always* provides the accurate, infinitely variable speed adjustability that is the key to efficient production.

With the turn of a handwheel, touch of a button, or automatically—*without stopping the machine*—you can change the speed to meet the need of every operation, every operator, and every operating condition. The result is higher rate of production and improved, uniform quality—at lower cost.

For machines now in service and the new ones you plan to buy, standardize on REEVES. Proved in 300,000 successful installations . . . available to you in a wider range of designs, sizes, speed ratios, and controls than any other make of variable speed drives. Send for free catalog No. FE 81a-G.

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accurate · variable
REEVES *Speed Control*

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Automatic Blender

Wherever you have to accurately measure and blend two or more liquids with positive uniformity, the Bowser Automatic Blender is the most economical and accurate answer.

Simple, quick-setting controls permit instantaneous setting of ingredient proportions. Double handling and large storage facilities for blended stocks are eliminated . . . and, important, liquids can be blended as needed.

Precision volumetric meter control makes ingredient variations mechanically impossible. Failure or slowdown of liquid supply to any meter stops or synchronizes the entire system—assuring uniformity at all times.

The unvariable accuracy of the Bowser Automatic Blender is the result of using Bowser Xacto-meter—world-famous for accuracy and dependability.

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Fort Wayne • Kansas City • New York • San
Francisco • Washington, D. C. • Hamilton, Ontario

Automatic Controls

—*Continued from page 100*

supervision is the so-called "mechanical brain" or master process control system.

Essentially, this master-control is an instrument capable of receiving diverse bits of incoming information, weighing these in relation to one another, and issuing controlling signals to servo-devices to keep processing at optimum.

Two basic forms of "mechanical brain" have appeared. One is known to industry as the electronic digital computer. This unit deals only in numbers; is capable of storing or "memorizing" reams of figures and using these in almost instant solution of complicated problems.

The other instrument type, known as the analog computer, has no "memory" but solves its problems direct by means of bridge-positioned servomotors that resolve incoming signals into a single controlled output. This device is the ultimate projection of closed-loop control.

Because the analog computer translates its reasoning into direct action—rather than a numerical answer—it is believed to be the type most suited to process control.

Actually, simple forms of analog computers already have seen wide application in food processing. Ratio control systems—where two measurements are instrument-resolved into a single control action—are an example. These have been used to regulate pipeline pea blanchers and to automatically blend beers.

Project this ability of the simple ratio controller in a central assembly of interrelated measuring systems and servo balancing motors, and you come up with a full-fledged analog unit capable of running a complex process.

Many pushbutton processes with only a modicum of human supervision already have appeared in food processing.

End (*Resume reading on page 102*)

Cold Sterilization

—*Continued from page 86*

high neutron flux in a reactor. Sources up to 10 kilocuries have been made available in this manner. Gamma rays of 1 million volts will penetrate about 15 in. of water.

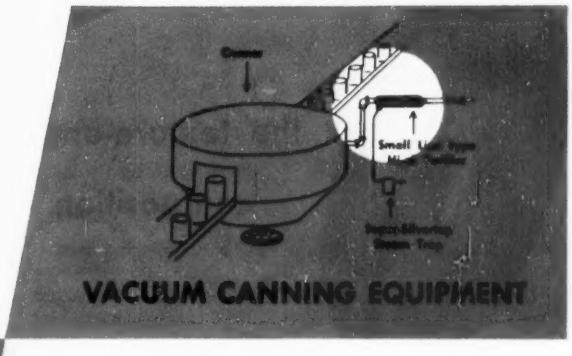
Some extensive animal feeding studies have shown no toxic effects from irradiated food.

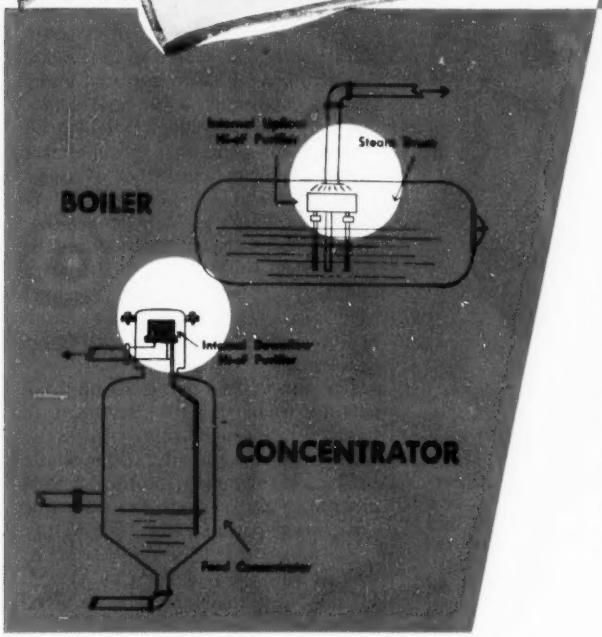
Cost of treatment varies with the product and the process. For cathode rays, indicated costs vary from a frac-

ELIMINATE THESE

VICIOUS ENEMIES of your

FOOD EQUIPMENT and PROCESSES





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● Mist, moisture, dirt and carryover can be as vicious an enemy as your food equipment and processes have ever seen. This damaging entrainment can cause havoc in steam systems, damage food equipment and contaminate processes and equipment. Hi-eF Purifiers keep these costly troublemakers from raising havoc with your food processes. These filterless units embody a new design of centrifugal separation that results in a new high in purification efficiency. Hi-eF Purifiers quickly pay for themselves in boilers, steam lines, concentrators, and vacuum canning equipment. Mail coupon for further details today.

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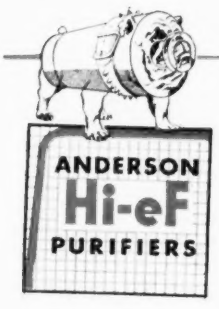

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Please send me a copy of Bulletins describing your purifiers for the food industry.

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DARCOVA PUMCUPS

the texture-engineered composition cups

give constant high efficiency despite wear

...outlast other packings over 3 to 1!

YOU name the fluid and we can tell you of similar Darcova Pumcup installations that save plenty of dollars. And it's simplicity itself to change over to Pumcups.

Here are two reasons why Darcova Pumcups are more efficient than ordinary packing . . . (1) The unique principle of Darcova Pumcups drastically reduces fluid slippage for the entire life of the Pumcup. (2) Texture engineered, Darcova Pumcups are made in many types to meet precisely a wide range of different fluid, pressure and temperature conditions.

Net Advantages — Pumcups maintain high volumetric efficiency, permit reduced operating speeds, save power, prolong equipment life and eliminate the need for frequent replacement shutdowns.

Send for free Bulletin No. 4401 on Pumcups for reciprocating pumps; Bulletin No. 4502 on Pumcups for air or hydraulic mechanisms . . . or ask for a Darcova engineer to help you solve your tough problems. *Write today!*

DARLING VALVE & MANUFACTURING CO.
Williamsport 20, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
PUMCUPS

tion to several cents per pound. Reliable costs for gamma ray treatment employing fission products are not available. Making fission products available on an economical basis is part of the development program for these sources.

What Must Be Done

The future of cold sterilization depends upon the outcome of a number of researches yet to be carried out. First of all, problems in organoleptic changes in foods must be solved. Unless irradiated foods are produced with normal acceptability characteristics, it is unlikely that the process will be successful. Where appropriate, the stability of irradiated foods under normal conditions must be adequate. Continued development work undoubtedly will produce better machine sources of radiation, but it is fair to say that at this time available sources are sufficiently developed to meet many requirements. Further work should improve performance and reliability and reduce costs.

A big question is the future availability of fission products. Since the Atomic Energy Commission under present conditions is the sole source of these materials, much will depend upon the program that it undertakes to make sufficient quantities of fission products available for commercial applications. Plans of the Commission, at present are not clear. Undoubtedly, these plans would be clarified if such problems as that of flavor changes were solved. Demand for fission products in quantities would undoubtedly expedite their availability.

It is conceivable that if fission products are to be used for treatment of foods, processing plants will be located at a reactor site. This could produce an obvious relocation of food processing units, where the economic aspects will permit.

This article was written by W. M. URBAIN, specially for the Anniversary Issue, at the request of the Editors. The author is Assistant Director of Research, Swift & Co., Chicago.

End (Resume reading on page 87)

Materials Handling

—*Continued from page 97*

In 1928, bulk handling existed only in grain-products plants and sugar mills. And even here finished products were shipped in containers.

About that time, however, liquid sugar was developed for processors. And, today, of all sugar used com-

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mercially, 1 out of 5 tons is liquid.

The phenomonal postwar growth of the first liquid sugar company is shown on the chart at the start of this article.

This shift to bulk handling has been accompanied by the development of special carriers, both rail and highway. Railroad cars especially designed for the handling of flour in bulk from the mill to the bakery are in common usage at today's modern plant. Highway trucks, especially designed, transport bulk flour, also bulk sugar.

On the bulk-liquid side, food processors now receive oils, shortening, chocolate, milk, sugar and corn syrups in liquid tank car lots. And, as the production figure per plant rises, this mode of handling materials will unquestionably increase. Even solids-waste are being handled at progressive food plants in specific-type trucks equipped with hydraulic accessories that pick up huge collector bins in single operation. Here, too, not only are savings effected in handling of materials but there is an accompanying upgrading in cleanliness and sanitation at the plant with use of these huge waste movers.

Advancements also have been made in the standard types of movers. Improved bucket elevator design has brought about better sanitation, easier cleaning. Introduction of more and larger processing equipment, heavier loads, and greater volume per plant all have resulted in increased use of monorails, and hoists in the food plant. In fact, in a recently modernized sugar operation, movement of sugar from storage entails the use of an overhead traveling tramrail equipped with a clam shell bucket. And a dessert-mix plant batches ingredients into carriers that roll on a rail to mixers.

Movers Serve Two Ways

Screw conveyors are available today in stainless steel with welded, smooth surfaces and having hinged troughs. Moreover, they are available with hollow flights that makes them bi-functional. They act not only as movers but operate as heat exchangers at the same time. The continuous brand oven is also in essence a process conveyor. Developments have been made in mass movers (flight-equipped chains or cables in ducts) which permit dry solids, granular and powdered, to be carried in any plane desired—vertical, horizontal, on inclines, around corners. These enclosed units also provide improved sanitation control. Belt conveyors have been developed that function as traveling tubes that can be automatically opened and closed at desired points for loading and unloading of materials. Conveyor belting

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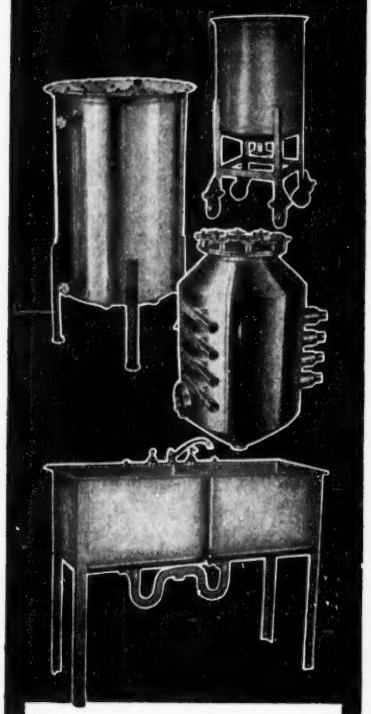

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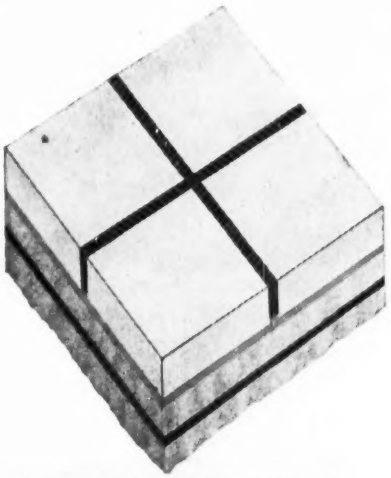

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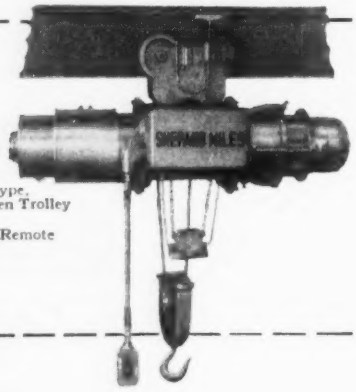

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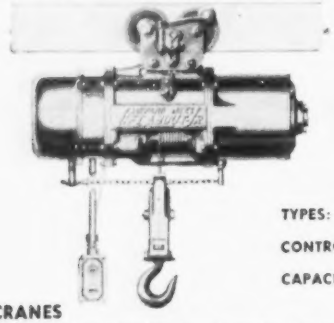

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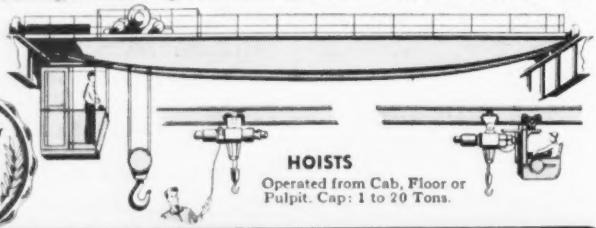

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now is available to permit packages to be carried on steep 45-deg. inclines. Also, self-centering rollers have come in to improve conveyor efficiency.

Introduction of stainless steels and other non-corrosive materials has increased the use of vibrating conveyors for the handling of many food products. Vibrating conveyors are now employed in the handling of light and relatively fragile products, as potato chips, corn chips, crackers, and similar products. Also, for the movement of granular items—like sugar, salt and rice—as well as broken glass.

This type mover has come into extensive use as a feeder—basic reason being its operating principle. With a horizontal plate subjected to vertical vibrations, pulverized, granular, or lumpy materials thereon are thrown upward repeatedly more or less in synchronism. Slope the plate downward, and there is a progressive movement forward—and the result is an excellent feeder. To vary the rate of feed, change the intensity of the vibrations or the plate slope.

Vibrating conveyors need not be inclined downward. In fact, they may be sloped upward. Rectilinear vibrations at an angle to the plate will throw forward the materials on the plate (in the form of a trough).

Stainless steel belts riding on continuous beds of water permit faster cooling in the handling of gelatin, confections, and similar products.

Flat-top conveyors of stainless materials have been improved in design so that bottles, cans, and glass jars are moved at high speeds and around sharp curves with little danger of spillage or breakage.

Many canning and freezing products—peas, lima beans, diced vegetables, berries—are now moved from one location to another hydraulically. A specially designed bladeless impeller centrifugal pump that avoids injury to the product forces it through pipe lines to the next location on the line. In many instances glass pipe lines are employed for these products as well as in dairies and in other plants for the movement of fruit juices. Numerous advances have been made in the design of sanitary stainless steel pumps that afford fast, thorough cleaning of these units.

Numerous other developments over the past 25 years have added greatly to handling efficiencies in food plants. At the shipping and receiving docks, hydraulic and mechanical devices raise or lower ramps or lift trucks to the level of the carrier's floor. Telescopic-boom and portable belt conveyors follow the loading or unloading operations inside the carrier.

End (Resume reading on page 98)

Useful New Books & Government Publications

Food Composition

FOODSTUFFS, THEIR PLASTICITY, FLUIDITY AND CONSISTENCY. *By G. W. Scott Blair. Published by Interscience Publishers, Inc., 250 Fifth Ave., New York. 1953. 264 pages; 6x8¾ in., cloth. Price $7.25.*

One of a series of monographs on rheological behavior of natural and synthetic products, volume offers a clear and up-to-date treatment of one of the most important facets of nutrition by experts in the starch, cereals, honey, and dairy products industries.

The effect of food composition—fluidity, plasticity, and consistency—on chemical and bacteriological processes, and on all-important quality control, are explained fully in this authoritative work. Chapters on major food processing industries are supplemented by a miscellaneous chapter covering confectionery, sauces, and jellies. Psychophysics and certain statistical techniques are dealt with in the concluding chapter.

Indexed according to author and subject, book contains an exhaustive bibliography and is illustrated with charts and photographs.

Conveyor Dictionary

CONVEYOR TERMS AND DEFINITIONS, *Second Edition. Prepared and published by Conveyor Equipment Manufacturers Association, 1 Thomas Circle, Washington 5, D. C. 1952. 64 Pages; 8½x11 in., paper. Price $1.*

Purpose of manual is to set up uniform terms and definitions for the many and varied types of conveyors. Each term is defined so that it can be understood by everyone concerned with the specification, manufacture, installation, and use of conveyors.

It lists 1,500 terms and graphically illustrates with line drawings more than 80 types of conveyors and parts.

Packaging Developments

PLANNED PACKAGING. *By Harry Jones. Published by MacMillan Co., 60 Fifth Ave., New York 11. 1950. 216 pages; 7½x10 in., cloth. Price $8.50.*

Though it contains a candid comparison of British and American packaging methods and design, book is primarily a history and criticism of British packaging. Stressing the important connection between packaging and industrial design, first half of the volume presents the exciting climb of the package from protective covering to a sales potential. The influence of World War II with its stress on durable containers receives special treatment.

In the second half of the book, the author discusses the after-effects of the war on packaging design, paying particular attention to the progress of the American packaging industry. The lack of design training in Great Britain is dealt with candidly.

A critical examination of the factors necessary for good planned packaging concludes the volume, dealing thoroughly with the factors of material, appearance, color and copy. Written with the goal of stressing less "commercial art" and more "planned packaging", book is of value to all concerned with packaging and its problems.

Lipid Refining

REFINING OF OILS AND FATS. *By A. J. C. Andersen. Published by Academic Press Inc., 125 E. 23rd St., New York 10. 1953. 204 pages; 6x9¼ in., cloth. Price $7.00.*

Refining is an important step in the processing of most edible fats and oils, whether obtained by pressing, solvent extraction, or rendering. The mechanics of refining, ranging from removal of fat-insoluble impurities and fat-soluble impurities, to process control and the layout of refineries, are dealt with deftly in this book.

Designed originally as the section on fat and oil refining in a contemplated English edition of Dr. H. Schoenfeld's *Chemie, Technologie und verwenung der Fette und Oele*, the manuscript has been published separately as a result of Dr. Schoenfeld's death.

Indexed, book lists large selection of references.

Dealing With Labor

LABOR PROBLEMS: CASES AND READINGS. *By George P. Shultz and John R. Coleman. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36. 1953. 456 pages; 6¼x9¼ in., cloth. Price $4.50.*

Containing material from both cases and readings to supplement standard texts in the labor relations field, book covers a wide variety of subjects: union organizing drives, union history and philosophy, contrasting bargaining relationships, economic effects of collective bargaining, congressional hearings,

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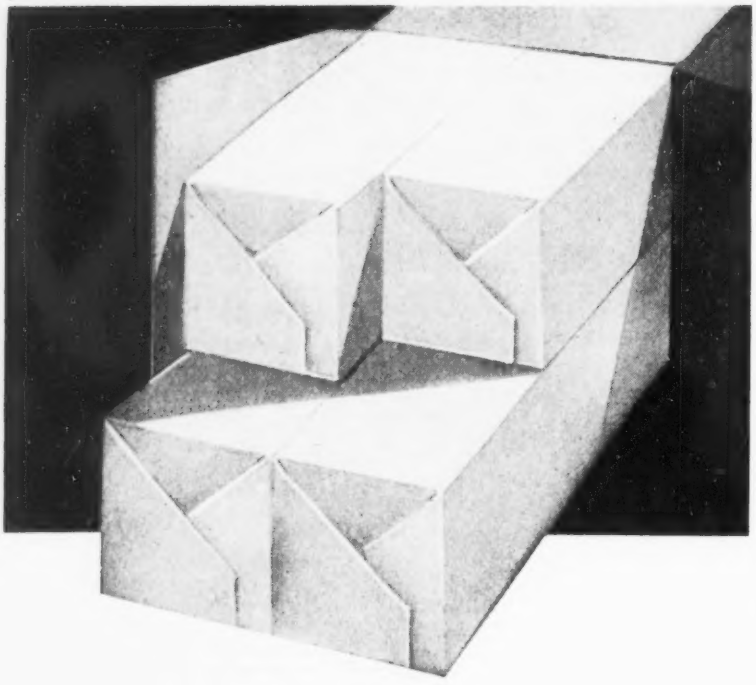

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labor laws and legal cases. Thus, the student encounters the actual major problems of labor relations.

The authors have chosen to present a full expression of a few selections on each topic rather than many abbreviated statements, believing that the student benefits more by this method. Topics have been chosen from the recent past wherever possible in order to emphasize issues with which the student is most concerned in his own mind.

There is a name index at the back of the volume.

Temperature Control

AUTOMATIC CONTROL OF HEATING AND AIR CONDITIONING. *By John E. Haines. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36. 370 pages; 6¼x9¼ in., cloth. Price $6.75.*

Invaluable to air-conditioning and heating engineers as a guide to automatic control, book takes the reader through a review of basic principles to practical application.

Striving for an approach that is complete and detailed, author has included information on such problems as measurement for control purposes, transmitting control signals, and actuating final control elements, electric and pneumatic control devices, control of domestic heating and air conditioning, unit heaters, ventilators, and radiant panel heating systems.

A chapter on control terminology definitions is also included. Book is indexed and illustrated.

Government Publications

INDUSTRIAL WASTES PRACTICES. *Florida Engineering and Industrial Experiment Station, University of Florida, Gainesville, Florida. 60 pages. Gives proceedings of the fifth national public health engineering conference held at University of Florida, May 1952.*

These recently issued documents are available, at the prices indicated, from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. When no price is indicated, the pamphlet is free and should be ordered directly from the Bureau responsible for its use.

FEDERAL AND STATE STANDARDS FOR THE COMPOSITION OF MILK PRODUCTS. *Agriculture Handbook No. 51, USDA. Compiles legal standards for composition of milk and manufactured dairy products as of Jan. 1, 1953.*

TEST OF A MECHANICAL REFRIGERATING UNIT DESIGNED TO MAINTAIN LOW TEMPERATURES IN MOTOR TRUCK TRANSPORTATION (*An interim report*). *USDA, Production and Marketing Administration, March* 1953. 18 pages. Gives data and results of one transcontinental test trip in November 1952.

FEDERAL SUPPLY CATALOG, DEPARTMENT OF DEFENSE SECTION. "SUBSISTENCE". *Group* 89. *Dept. of Defense, Defense Supply Management Agency, Washington* 25, *D. C. Feb.* 1953. 43 *pages.* 7¾x10¼, *paper. Price* 25c. Lists all food items which may be stocked, purchases, and issued. Contains 1131 items.

—*End*—

Mixing

—*Continued from page* 172

around controls, made possible by the advancement or progress in scientific instrument design, resulting in a tremendous upsurge in production capacity even though the principles and general methods have changed to a lesser degree.

One of the exceptions is the marshmallow field, where continuous mixing has replaced the batch method with the high-speed rotor machine described earlier. With mashmallow there has been one step further—development of a depositor as part of the unit. This has changed an unsanitary, difficult batch operation to a 100% continuous and sanitary one with better quality and cost controls. The improved sanitation, due to change in process, is obvious. In the continuous method the liquid pre-mix material is pumped through closed equipment and differs from the batch method, where the jelled syrup was whipped up to marshmallow consistency in an open bowl.

Continuous marshmallow mixers have also made it possible to reduce the amount of gelatin used in the product and produce a drier finished product more suitable for chocolate dipping than that made with conventional mixers.

Mayonnoise Now Continuous

Improvement in mayonnaise mixing equipment follows the same pattern. Namely, from batch to continuous. However, most batch-type machines originally used for quality mayonnaise were custom built to the processor's specifications. They had relatively small capacities—in the neighborhood of 50 lb. per batch. Many units were

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necessary for high plant production. Mixing time required ranged from 10 to 20 min., and 10 units were needed to make 300 lb. per hr.

Difficulties in making mayonnaise restricted mixer size. Mayonnaise is an oil and water emulsion, not a simple mechanical ingredient suspension such as a cake batter. Today, one continuous mixing unit, with two operators, can make up 6,000 lb.

In mayonnaise, the oil is subdivided in drops by the mixer and covered with eggs. And in this state it floats in the water phase.

To accomplish this it has been necessary to add the oil slowly into the full batch of eggs to start the adsorption process and then stabilize it by additional mixing, thus actually taking two steps—premix and final mix. It is still necessary to make batch premixes for the continuous final mixer, but the production can be multiplied a dozen times with improved quality, greater shipping tolerances, extended shelf life, and at a lower cost.

The new disk blender, previously mentioned, is particularly effective in forming mayonnaise and salad dressing emulsions continuously from a water-in-oil slurry of ingredients. In field test production, rates of 8,000 lb. per hr. of high quality premixes are maintained.

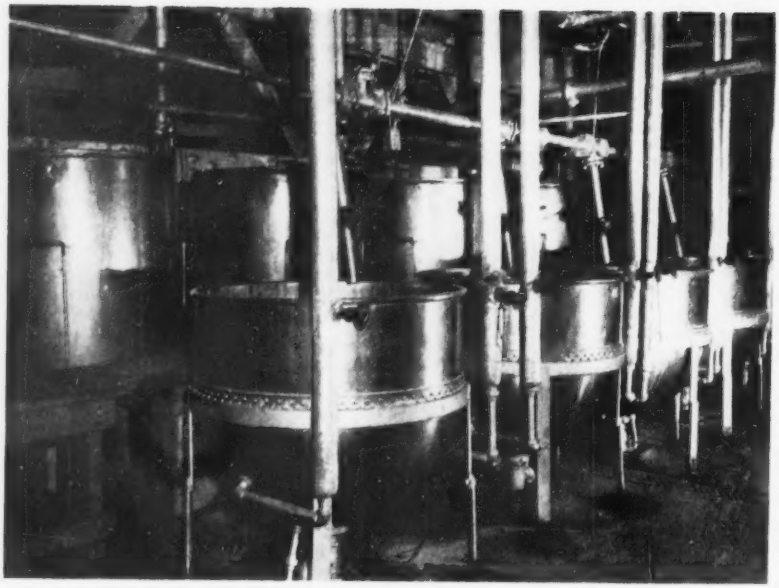
Design and performance improvements have steadily been made in the standard mixers, such as the ribbon type, and in homogenizers and colloid mills. Much of this has been in the direction of more santiary construction and easier cleaning and maintenance. And a rotating-plate homogenizer-emulsifier has been built with spring-backed plates to maintain preset clearance as wear takes place.

Volume production of dry mixes—pie crusts, cake mixes, baking flours—have skyrocketed in the postwar years. The greatest advance in engineering in this field has resulted primarily from the improvements in feeders and proportioners.

Accurate, dependable, continuously controlled ingredient feeding is now a reality. In some installations, ingredients are fed into a common screw conveyor, which discharges into a high speed continuous mixer. The latter unit can receive finely granulated or powdered ingredients and blend them continuously by action of high-speed centrifugal force at rates up to 200 lb. per min.

This article was written by TED JENSEN, specially for the Anniversary Issue at the request of the Editors. The author is a consultant and development engineer with office in New York City.

End (Resume reading on page 175)



Oakite Descaling Prevents Permanent Injury To Kettles

Plant reports clogged water jackets of blending kettles restored to full operating efficiency by Oakite materials

There were 17 of these chocolate blending kettles at this processing plant. And they weren't transferring heat properly. Investigation showed why. Their water jackets were choked with a baked-on algae growth plus ½" wall of lime scale. Oakite was consulted.

A two-pronged attack on this problem was suggested by the Oakite Technical Service Man, based on his wide experience with various tough cleaning jobs in food plants. First, a solution of Oakite Compositions No. 19 and No. 53 to remove the heavy outer black deposits. Then descaling by circulating a solution of lime scale dissolver, Oakite Compound No. 32.

Results: Water jackets cleaned down to the base metal—rated heat transfer regained. And 17 costly kettles saved from permanent injury.

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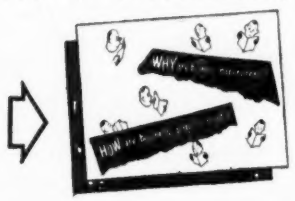

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The Tickometer can handle up to 1000 pieces per minute—eight to ten times faster than your most experienced manual workers. It cancels, endorses, imprints and counts such other items as tags, coupons, checks, tickets, invoices—practically anything made of paper.

The Tickometer is rented, not sold. Requires no capital investment. Service is available from 201 locations, coast to coast. Ask the nearest Pitney-Bowes office for a demonstration—or send coupon for the free illustrated booklet.

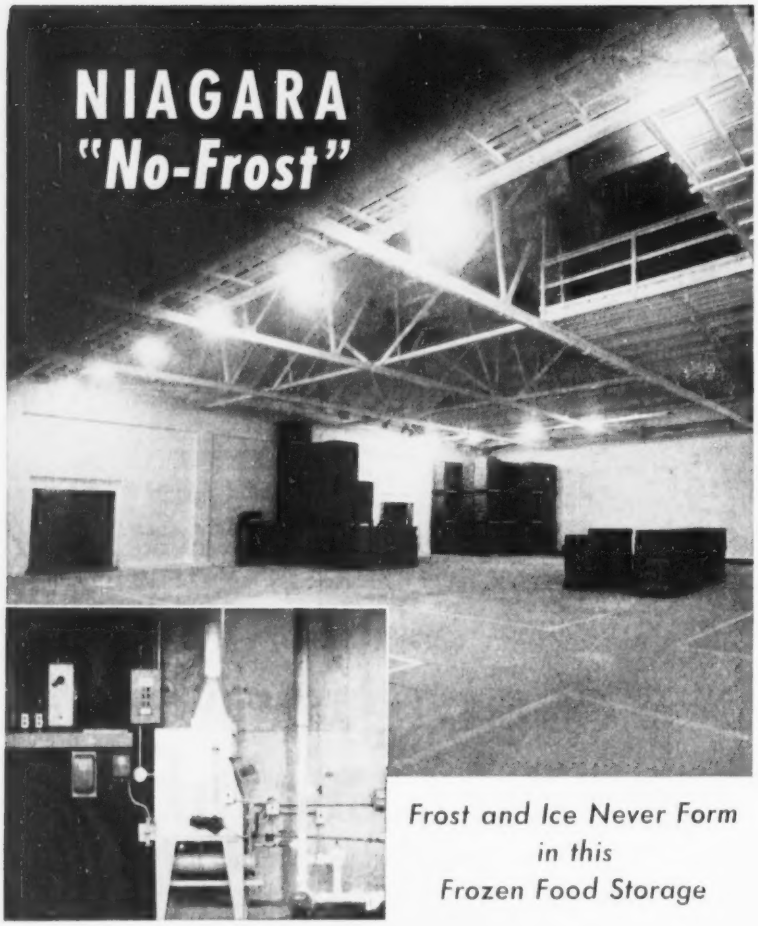
PITNEY-BOWES
Tickometer
Counting & Imprinting Machine
Made by the originators of the postage meter . . . offices in 93 cities in U.S. and Canada.

PITNEY-BOWES, INC.
3815 Pacific St., Stamford, Conn.
☐ Send Tickometer booklet
☐ Send case studies

Name _____

Address _____

For more information, use coupon on page 207.



Frost and Ice Never Form in this Frozen Food Storage

SAVE TROUBLE AND EXPENSE EVERY DAY IN PRE-COOLING, FREEZING AND STORAGE; PROTECT FRESH OR FROZEN FOOD QUALITY

The Niagara "No-Frost" Method gives you always the full capacity you paid for in your refrigeration, NEVER, not even partially, interrupted for defrosting. You can handle large "live" loads easily. The controls are simple and always give you accurately the temperature and humidity you want. Temperatures never rise to interrupt the "pull-down". You are free of troubles; your rooms stay clean and sweet with easier maintenance and less labor. You save power; your compressors run at higher suction pressures. For every refrigerated room for temperatures below 32° F. this method gives you better product quality at lower operating costs. Many of the finest installations in the industry, both large and small, prove the benefits of the Niagara No-Frost Method.

Write for the No-Frost story and data on its application to your problem. Ask for Bulletin No. 105.

NIAGARA BLOWER COMPANY
DEPT. FI405 LEXINGTON AVENUE, NEW YORK 17, N. Y.

OVER 15 YEARS OF SUCCESSFUL EXPERIENCE PROVES THE VALUE OF NIAGARA NO-FROST

Heat Transfer

—*Continued from page 124*

However, the low overall thermal efficiency of h-f techniques—about 50% as against 89% with a strip heater—and high initial cost definitely limited commercialization of this equipment. About the only working uses to date have been in deinfesting grain products in packages and on a belt, and in defrosting frozen pork bellies.

Current studies at the American Meat Institute Foundation, however, indicate that good h-f in-can sterilization, at a cost of about 0.2 to 0.3c. per pound, may lead to commercialization. Quality is superior to steam-retorted products.

Infra-red electric lamps have been used for melting chocolate broiling meat balls, dehydrating fish and spot heating various equipment in process lines.

Baking and Roasting

Many improvements have taken place over the past quarter-century in baking and roasting equipment.

Continuous, traveling tray ovens were already the order of the day in '28, and tunnel type ovens with traveling bands were beginning to appear. Insulated sheet was replacing the long-accepted refractory brick wall, providing satisfactory heat distribution without the great heat ballast of the brick.

Heating methods also were changing. Baking chambers had been indirectly heated from a fire chamber by combustion gas and brick radiation, or from steam tubes placed under the baking floor.

Around 1925, electrically heated ovens appeared. Power calculations on a typical West Coast oven showed a consumption of 97 kwhr. per 1,000 lb. of bread at an estimated cost of about 1¢ per kwhr. Indirect, oil fired ovens of the same capacity were usually capable of baking at a cost of $.60 to $.70 per 1,000 lb. of bread.

However, direct electric heat boosted the interest in direct gas-fired units—the most prevalent type today.

Placing burners directly inside the oven reduced overall height of its baking chamber and improved control of atmosphere and heat application. Use of a grid-hearth conveyor and lighter weight construction increased thermal efficiency to nearly 50% when gas fired—almost four times better than coal and three times more efficient than oil firing.

Today, the smaller, indirectly fired

ALLIGATOR
V-BELT DRIVES
. . . you can make up all lengths of V-Belts quickly

"B" DISPLAY UNIT

- ★ **Units contain V-Belting, Fasteners and Tools** — everything you need in one package for all emergencies when correct endless V-belt is not available.
- ★ **Avoid costly delays,** shut-downs and pickups.
- ★ **Eliminates costly dismantling** of machinery when re-belting.
- ★ **Completely modern make-up units** that give you peace of mind as well as stock on hand.
- ★ **Less Stretch and Follow-Up Maintenance.** Just One Strong Joint.
- ★ **Alligator V-Belt Drive Units,** available in sizes A, B, C and D. B size furnished in display box.
- ★ **Order from your distributor. Ask for Bulletin V-215.**

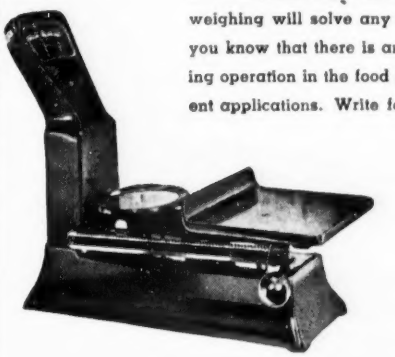
FLEXIBLE STEEL LACING CO.

4646 Lexington St. Chicago 44, Ill.

Two EXACT WEIGHT end tower scales equipped with special commodity holders for packaging franks.

Solving the Consumer Packaging Problem . . .

Consumer packages fall into one of three classifications: underweight, overweight and accurate weight. The problem is to eliminate the first two . . . retain the latter at costs to assure a profit. Eliminating the overweight package saves product and thus halts a give away program. Correcting underweight protects you against confiscation of a shipment by weights and measures officials. Simple check-weighing will solve any normal consumer packaging problem. Did you know that there is an EXACT WEIGHT Scale for every packaging operation in the food industry and this covers hundreds of different applications. Write for details for your packaging task.



EXACT WEIGHT Scale Model #213-S, the most popular consumer packaging scale—Features (1) high speed operation due to extremely short platter fall, (⅛") (2) end lower construction which takes up less bench space and permits uninterrupted production across the scale, while commodities are being weighed all in direct line of vision, 1 lb. beam, notched type Dial 1 oz. over and under x ¼ oz. graduation—Capacity to 3 lbs.

EXACT WEIGHT SCALES

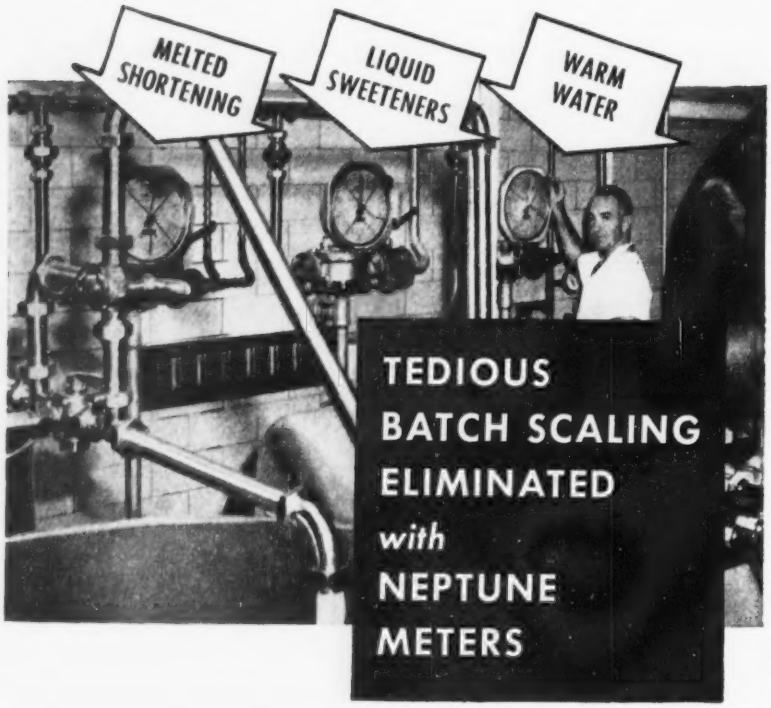
BETTER QUALITY CONTROL
BETTER COST CONTROL

THE EXACT WEIGHT SCALE COMPANY

910 W. Fifth Ave., Columbus 8, Ohio

2920 Bloor St., W., Toronto 18, Canada

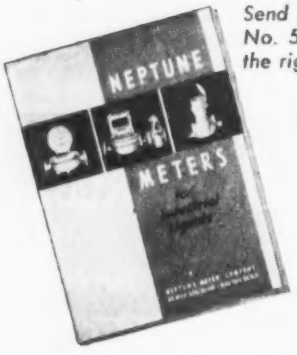
For more information, use coupon on page 207.



With this ingenious homogenizing system, First National Stores, Inc. pre-mixes salt, sugar, milk, shortening and water into an emulsion that can be pumped easily to their bread mixers. These pre-mixed batches are big, working from whole bags or drums of dry ingredients, with Neptune Auto-Stop meters automatically, accurately delivering the right amount of water, melted shortening and liquid sugar to the pre-mix tanks.

The system eliminates tedious batch scaling, produces more uniform quality by eliminating human errors, saves ingredients that adhere to scaling buckets, tightens up on inventory control, and saves time lost in cleaning up.

Start you thinking? Let your imagination tour your plant. Aren't there several spots where accurate liquid metering can speed up batch mixing, simplify processing control, wipe out spoilage or spillage, or keep tabs on liquid inventories and costs? Ask our field engineers for ideas—put over 60 years of experience with more than ten million meters to work for you.



Send for new Industrial Meter Bulletin No. 566-NF — it shows how to select the right meter for your process.

NEPTUNE METER COMPANY
50 West 50th Street • New York 20, N. Y.

Branch Offices

ATLANTA • BOSTON • CHICAGO
DALLAS • DENVER • NO. KANSAS CITY, MO.
LOS ANGELES • LOUISVILLE • PHILADELPHIA
PORTLAND, ORE. • SAN FRANCISCO

Canadian Factory: TORONTO 14, ONT.

batch type ovens, such as the peel or draw-plate units, have been preponderantly replaced with larger, direct-fired semi-continuous traveling tray, continuous tray, or tunnel ovens they have featured a high thermal efficiency.

Roasting Progress

A major advance in coffee, nut and cacao bean roaster came in the mid-'30's. When the chamber was separated from the roasting cylinder, and hot gases of combustion were blown at high velocity over the beans. Rapid gas movement had the effect of "washing off" most of the adhering insulating gas film around each bean, which greatly stepped-up heat transfer. And, because of this, it was possible to bring the temperature of the heating medium down to a gentle 800-900 deg. F., which would not burn chaff or degrade the oils, waxes and fibre of the product.

Continuizing this process was the next step forward. An inclined rotating cylinder was set up for peanuts and cacao beans that could roast over 1,500 lb. per hr. continuously. Heating gases, generated in an external burner chamber, were blown up and through the beans in transit, with product temperature never exceeding 500 deg. F. Fuel consumption was about 50 cu. ft. of manufactured gas per 100 lb. of product.

In 1947 a commercial continuous roaster was designed for coffee employing the hot gas circulation principle. This consisted of a revolving kiln-like cylinder for retaining the beans, served by a duct system for circulating hot gases from a sizable external combustion chamber. Integrated with the roasting chamber was a short cooling cylinder for damping bean temperature with cold air blasts. An air-lock system prevented seepage between hot and cold chambers. Capacity was 7,500 lb of green coffee per hr.

New German Unit

Very recently, a compact vertical continuous roaster using steam as its heating medium was introduced from Germany. Primarily designed for nuts and low temperature drying of kernels or granular materials, the unit employs a spiral gravity conveyor that moves the product rather gently through successive steam heating zones and an air-cooling zone.

Because of the good controllability of steam as a heating medium, and the reclaim of heat by countercurrent cooling air circulation, possible fuel savings up to 70% are claimed.

End (Resume reading on page 127)

How to keep informed on the "with what" part of your business

AT YOUR FINGER TIPS, issue after issue, is one of your richest veins of job information—advertising. You might call it the "with what" type—which dovetails the "how" of the editorial pages. Easy to read, talking your language, geared specifically to the betterment of your business, this is the kind of practical data which may well help you do a job quicker, better—save your company money.

Each advertiser is obviously doing his level best to give you helpful information. By showing, through the advertising pages, how his product or service can benefit *you* and *your* company, he is taking *his* most efficient way toward a sale.

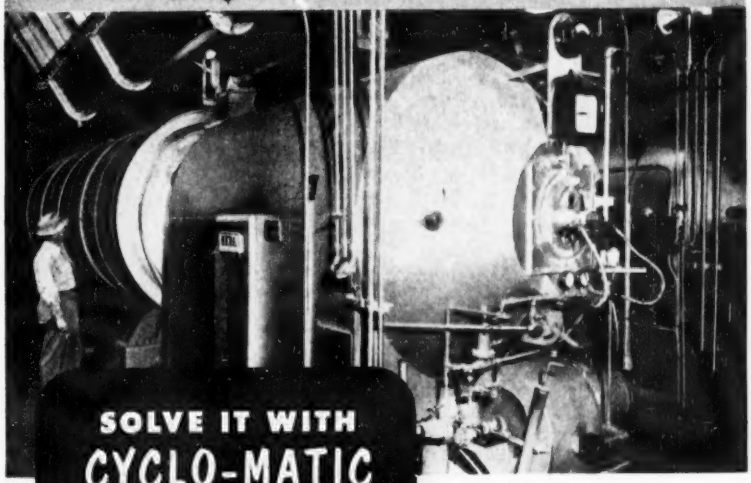
Add up all the advertisers and you've got a gold mine of current, on-the-job information. Yours for the reading are a wealth of data and facts on the very latest in products, services, tools . . . product developments, materials, processes, methods.

You, too, have a big stake in the advertising pages. Read them regularly, carefully to keep job-informed on the "with what" part of your business.

McGRAW-HILL PUBLICATIONS

WHAT'S YOUR DEHYDRATING PROBLEM?

Cost? Product Quality? Space Limitations? Vitamin Loss? Uniform Color and Dryness? Fuel Consumption? Installation?



SOLVE IT WITH CYCLO-MATIC DRYING

FOUND ONLY IN ARDRIER DEHYDRATORS

CYCLO-MATIC Drying solves the dehydrating problems listed above, and many more, by its efficient application of the "flash" drying principle and simple 3-pass drum design, an exclusive Heil feature.

The three drums of the dryer are arranged concentrically, one within the other, all mechanically interlocked and rotating at the same speed. Material enters the center cylinder at the burner end. As it progresses, it is repeatedly carried to the top of the cylinders by built-in flights and showered through the drying medium. Rapid moisture evaporation keeps material relatively cool (130°-155° F.) as the drying fan draws it through the center cylinder, then back through the intermediate cylinder, and forward again through the outer cylinder. Velocity and heat of the air stream are different in each of the three drums to meet changing rates of evaporation. Maximum exposure of all particles to the heated air in a "flash" of time assures maximum retention of all vitamins and nutrients in the material.

Find out about the many other features that help you increase product quality at lower cost. Send the coupon for bulletins.

ARDRIER DEHYDRATORS are manufactured for ARNOLD DRYER COMPANY by THE HEIL CO.

HIGHEST QUALITY OUTPUT FOR

- Apple Pomace
- Beet Pulp
- Blood Meal
- Cannery By-Products
- Citrus Pulp
- Crab Scrap
- Distillers' Grains
- Fish Meal
- Meat Scraps
- Potatoes
- Sages
- Sludges—Vacuum Filtered
- Sugar Cane Bagasse
- Tankage
- Tomato Pomace
- Wet Corn Millers By-Products
- Yeast Grains

and

Many other products and wastes of the beverage, canning, meat packing, confectionery, dairy, milling, and other food processing industries.

Tear out coupon and mail today!

ARNOLD DRYER COMPANY, Dept. 25103
3025 W. Montana St., Milwaukee 1, Wis.

Gentlemen: Please send me Ardrier Dehydrator bulletins.

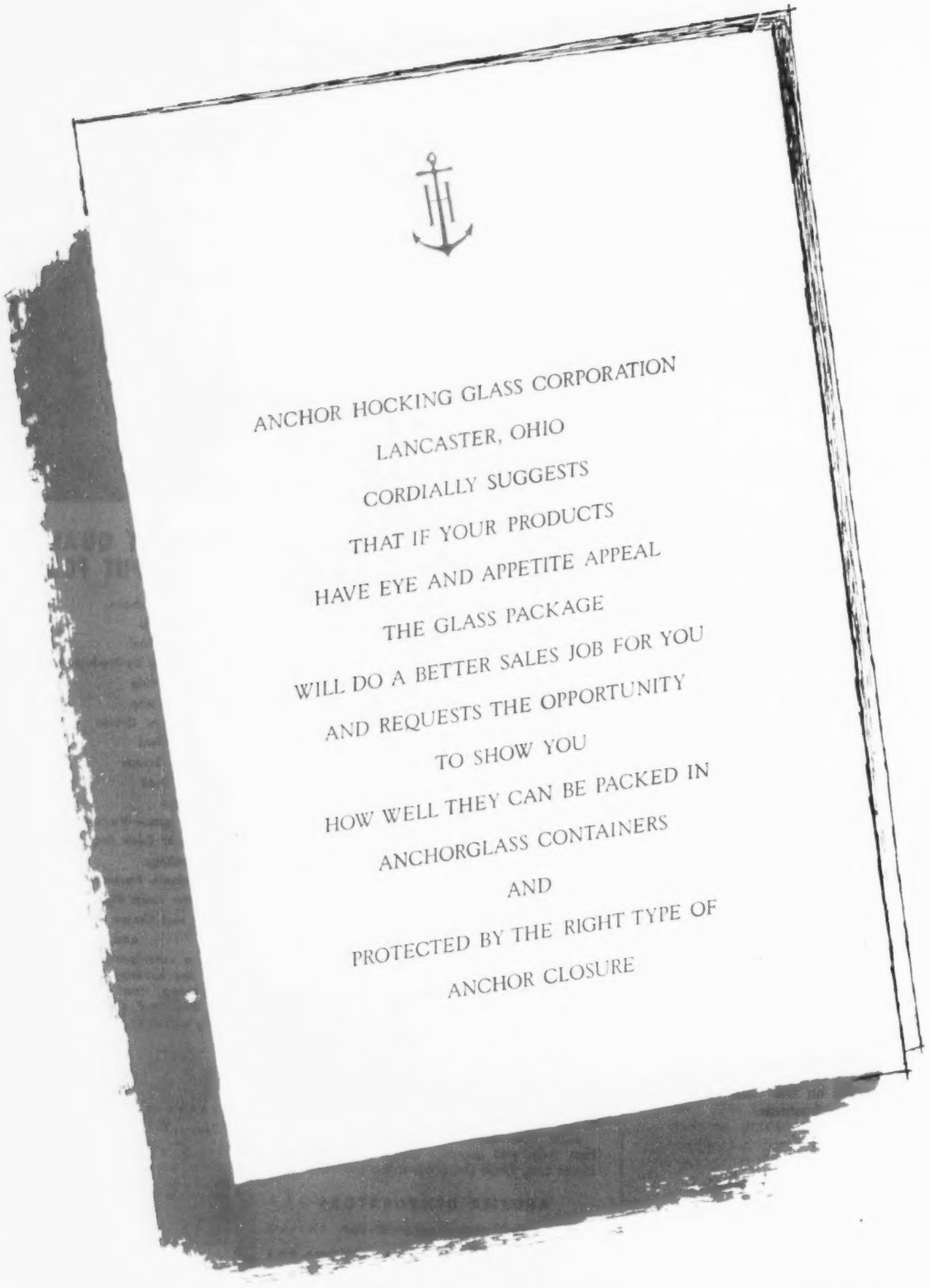
Name_____

Title_____ Company_____

Address_____

City_____ Zone____ State_____

ADC-1


ANCHOR HOCKING GLASS CORPORATION
LANCASTER, OHIO
CORDIALLY SUGGESTS
THAT IF YOUR PRODUCTS
HAVE EYE AND APPETITE APPEAL
THE GLASS PACKAGE
WILL DO A BETTER SALES JOB FOR YOU
AND REQUESTS THE OPPORTUNITY
TO SHOW YOU
HOW WELL THEY CAN BE PACKED IN
ANCHORGLASS CONTAINERS
AND
PROTECTED BY THE RIGHT TYPE OF
ANCHOR CLOSURE

KEEPING UP WITH THE FIELD

Technical News • Washington Highlights • Economic Trends • Labor Developments

New Uses for Shells, Pits

Anti-skid agents for auto tires, fillers for fine plastics, litters for poultry houses are among uses developed for discarded nut shells and fruit pits.

Studies by Bureau of Agr. & Ind. Chemistry, USDA, in cooperation with nut shelling and food processing companies showed that coarse particles of hard shells can be incorporated in tires to give superior non-skid properties. Finely ground shells and fruit pits are excellent fillers in plastic molding compounds. Peanut and almond shells are highly absorbent and are used to keep poultry-house floors clean.

Ground peanut shells can be incorporated in a cork substitute developed during World War II. And almond and peanut shells can be mixed with commercial fertilizer to provide bulk, retard caking, and improve flow characteristics.

Apple-Handling Savings

Boxes of apples can be handled at packing and storage houses at approximately one-half present costs by adoption of improved methods and equipment, according to a USDA study in Washington State.

It was demonstrated that whereas the conventional method, involving common 2-wheel hand trucks and belt movers costs $60.28 per 1,000 boxes, other methods were notably cheaper: With clamp-type 2-wheel hand trucks, $54.62; with industrial clamp-type lift trucks of 24-box capacity, $37.75; and with industrial fork-lift trucks and 48-box pallets, $31.99. In addition, the latter method also reduced bruising and deterioration of fruit.

Bands Aerate Cartons

New approach to the problem of adequate air circulation of frozen and refrigerated foods during transportation and storage is employment of special strapping bands that afford space between master cartons.

Bands have ½ in. raised surfaces of variable lengths (depending on package size) that prevent cartons above and alongside from coming in direct contact and closing off air spaces. The bands are of two types—metallic and non-metallic—reported adaptable to all standard size cartons.

Responsible for the development is Murray Lang, for many years in the meat processing end of the frozen food field. Bands will be merchandised by Refrigerated Package Spacers, 60 Wall St., New York City.

Chemical Show Spotlight To Include Food Strides

Striking advances in chemical engineering—many related to the food field—will be reflected in a massive display of some 500 exhibits when the curtain rises on the 24th Exposition of Chemical Industries at Philadelphia's Commercial Museum & Convention Hall.

Slated to run from Nov. 30 to Dec. 5, the display will comprise chemical substances, chemical materials, structural and protective materials and coatings, construction materials, chemical process equipment, materials handling, production equipment, laboratory supplies, research and testing instruments and controls. Exhibits run nearly 250 classifications.

Notable is the emphasis many exhibitors are placing on new plant and process development. One firm long engaged in erecting and equipping complete manufacturing layouts will particularly illustrate facilities for designing and building industrial units, specifically showing actual equipment employed in food plants.

Mellorine Scores 4 to 2 In Recent State Rulings

Six more states have recently passed laws governing manufacture and sale of frozen desserts in which vegetable or animal fats are used to replace butterfat. With four of these rulings permitting manufacture of the product, the total number of states now Okaying it stands at seven.

In Oregon the law permits such products provided they are labeled "Mellorine–containing vegetable (or animal) fat."

The Alabama law authorizes use of vegetable fats in Mellorine but prohibits use of animal fats.

Oklahoma allows use of either vegetable or animal fats. Packages must be labeled "Mellorine," followed by indication of the generic type of edible fat used.

The California law permits the making of imitation ice cream, but declares that it shall not be manufactured, processed, frozen, handled, distributed, or sold in any place where ice cream or ice milk is so handled.

On the negative side are Rhode Island and Vermont, which have passed laws prohibiting manufacture of Mellorine. In Vermont and Washington, previously passed laws concerning filled dairy products prohibit use of fats or oils other than butterfat.

McGraw-Hill Publishing Co. President Dies

Everybody who knows FOOD ENGINEERING has known Curtis McGraw, president and chairman of the Board of the McGraw-Hill Publishing Co.

CURTIS W. McGRAW

The enduring mark of his leadership in the task of keeping business well-informed, shaping the technical development of industry, and holding the nation to an awareness of its power for greatness and goodness must remain on these pages. But it is something out of the lives of all of us that he died last month at the age of 57.

Mr. McGraw was the third son of the late James H. McGraw, Sr., founder of the publishing company. Following foreign service as a major of infantry in World War I, he was graduated from Princeton University in 1919. He was associated with the McGraw-Hill Publishing Co. since 1920, when he joined the McGraw-Hill Book Co. (McGraw-Hill subsidiary), of which he was vice-president, treasurer, and director from 1927 to 1950.

He became vice-president and treasurer of the McGraw-Hill Publishing

ROBO-LIFT
HANDLES FOOD PRODUCTS

so Gently

NO DIGGING
NO SCOOPING
NO SPILLING
OR
BREAKING

Standard Model A-1070 with 8 cu. ft. hopper. Stainless Steel in contact with product.

- Gentle vibratory motion handles many dry products . . . Drugs, confections, foodstuffs, chemicals, pharmaceuticals, etc.
- Product touches only stainless steel.
- Standard hopper shown is not integral part of conveyor, can be made portable.
- "No-spill" buckets invert to discharge. Angle of discharge variable.
- All parts easily accessible. Entire conveyor can be enclosed if desired.
- Many variations of basic model possible.
- Save labor, time, floorspace.
- Preserve fragile products from damage
- In use by Beech-Nut, Buitoni, Kellogg, Kraft, Lipton, Post Cereals, Brach, Rockwood, Sharpe and Dohme, Safeway Stores, Lance, Inc., A. & P., Salada Tea Co., Campbell Soup, and many other leaders.

MANY DIFFERENT MODELS

Write for descriptive literature on Robo-Lift Bucket Elevating Conveyor and also the Robo-Lift Tray Elevating Conveyor.

Capacity Range up to 25 cu. ft. per minutes.

Counsel
MACHINE COMPANY, Inc.
8 Hathaway St., Wallington, N.J.

Co. in 1943, and in February 1950 was elected president and chairman of the Board.

Mr. McGraw was active in numerous civic affairs, and was a member of the Postmaster General's recently appointed Advisory Board of the Post Office Department. He was a past director and past president of the American Book Publishers' Council, also a director of the Magazine Publishers' Assn.

Georgia Station Launches Ration Shelf-Life Tests

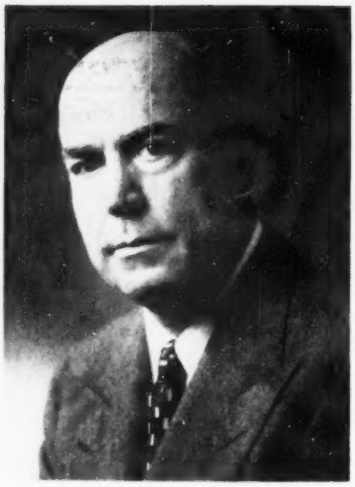
With renewal of contract from the QM Food & Container Institute for the Armed Forces, Chicago, the Food Processing Department, Georgia Experiment Station, is now entered on a project of testing shelf life of some 50 military food items.

The rations include soluble coffee, crackers, bread, peanut butter, ham, beef, cheese, milk, soup, fruit cocktail, ice cream powder, and many others, with 34 packed in cans and 16 in flexible containers.

In the course of the work, climatic and weather conditions of the entire world will be simulated in the laboratory, states Dr. J. G. Woodroof, supervisor of the project and chairman of the Division of Food Processing, University of Georgia.

Temperatures of the product will be ranged from −20 to 100 deg. F. and relative humidity from 40 to 95 percent.

As many as 20 persons will engage in the program, removing the rations from storage and inspecting them at intervals of one to six months.



DONALD C. McGRAW

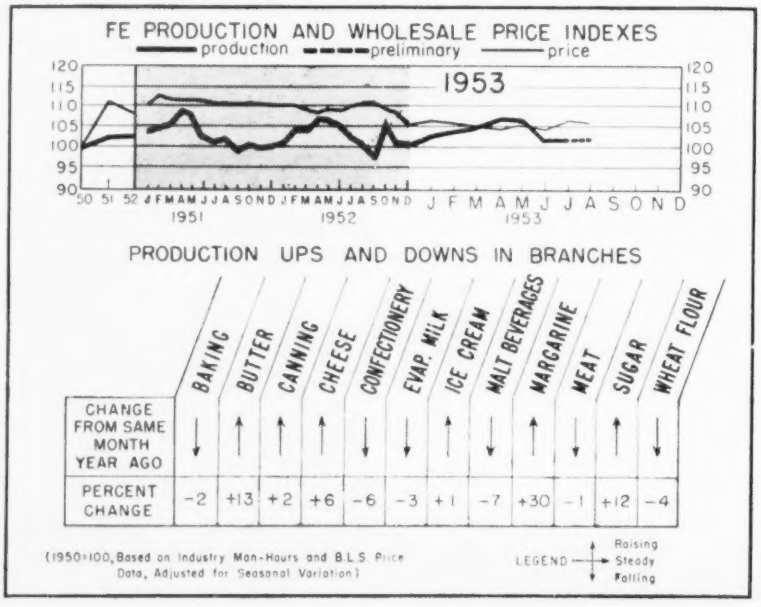
Named to Presidency Of McGraw-Hill

New president of the McGraw-Hill Publishing Co. is Donald C. McGraw, youngest son of Founder James H. McGraw, Sr.

A company director since 1935 and vice-president for manufacturing and general services since 1945, Donald McGraw was a consultant to the Publishing & Printing Division of the War Production Board in World War II.

He has responsible for the handling of all contracts for printing and binding, engraving, and paper supply for the entire McGraw-Hill operation since 1933, in which year he was made secretary of the company and put in charge of production and manufacturing.

It was in 1919 that Donald Mc-



Graw joined the company, after serving with the U. S. Navy in World War I and attending Princeton University. His initial association was as a member of the staff of *Chemical & Metallurgical Engineering*, now *Chemical Engineering*. In 1921 he transferred to the printshop side of company activities, and he assumed supervision of these operations in 1924.

Since 1950, Mr. McGraw has, in addition, been a director of the McGraw-Hill Book Co. and the Newton Falls Paper Mill, in which McGraw-Hill has a half-interest.

Other officers of the McGraw-Hill Co. continue unchanged.

Hors d'Oeuvres

Whale milk has three times as much butterfat and ten times as much protein as cow's milk, say British scientists. But who will milk the whales? Mermaids?

Farm families represent a big market for concentrated canned milk, believes an Iowa expert. Naturally. A prosperous cash-crop farmer should be bothered with bovines!

The efficient egg-producing chicken battery is frowned upon by England's Royal SPCA. British socialism regiments industry and people. Are hens superior?

Closed-circuit TV has become practical and economical for use in factories. Soon the boss' eye will be everywhere. Isn't science awful?

Nutritionists say that the eye-vitamin A content of cucumbers increases during the pickling process. Maybe this explains why pickled people see double.

Vital-to-you statistics: As of Aug. 10, in the forenoon, EDT, there were 160 million food consumers in the U.S. One is born every 8 sec.; one dies every 21 sec.; one enters the U.S. every 2 min.; and one leaves every 17 min. It adds up to 2½ million more eaters a year—or 1 more every 12 sec. Busy place, the U. S.

To package the 44 million gallons of frozen concentrated citrus juice, a billion tin cans are made every year. Even Henry Ford never had it so good.

Cheese has been made experimentally from cotton seed kernels. Good idea for Swiss. Boll weevils can eat the holes into it.

Chlorophyll has been used in chewing gum, dog food, and even a "breathless" beer developed by a British essence manufacturer. But its best application is in aspirin to cure a stinking headache.

One fighter plane costs as much as ½ million bushels of wheat. Might be cheaper to feed, rather than fight, our way to world freedom.

STEEL

Every Kind

Our stocks of Certified Quality Steel are large and becoming more complete. Quick, dependable service is assured.

Plates, Structurals, Bars, Sheets, Tubes, etc. . . . Carbon, Alloy and Stainless Steels . . . .

RYERSON

Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles, San Francisco, Spokane and Seattle

Another Large Firm Adopts

$35 NICHOLSON TRAPS AS TEMPERATURE CONTROLS

Because they serve effectively as temperature controls as well as steam traps, and cost only about $35, Nicholson expansion steam traps are being increasingly installed in place of temperature regulators. A large processor recently installed these Nicholson units on outdoor storage tanks after thorough tests showed a less than 2°F variation in outlet condensate temperature. Regulators had been costing them $110.00 to $200.00, with cost of a trap added.

Nicholson expansion steam traps are easily adjusted to pass condensate at any temperature below 212°F. Because there is only one moving part, remarkably low maintenance costs are being shown. Easily installed, usually without supports. Lengths, 9" to 40". Press. 0 to 250 lbs. Freezeproof.

For All Equipment Using Steam or Hot Water

Dryers	Pipe Coils
Evaporators	Radiators
Heat Exchangers	Retorts
Heaters	Separators
Kettles	Steam Stills
Paper Machinery	Storage Tanks

CATALOG 751

193 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

For more information, use coupon on page 207.

For Eye-Level Readings...

AUTO-LITE

...TEMPERATURE INDICATION

Auto-Lite offers many thermometer styles, permitting plant-wide temperature observation at low cost. Standard temperature ranges from minus 60°F to plus 750°F. Send for latest catalog showing various types.

Model F-1 temperature indicator—Rigid stem or capillary tubing for EYE-LEVEL remote reading. Priced from $22.

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
TOLEDO 1, OHIO
NEW YORK • CHICAGO • SARNIA, ONTARIO

Tune in "SUSPENSE"... CBS Radio Mondays... CBS Television Tuesdays

TEMPERATURE INDICATORS & RECORDERS

FULLY AUTOMATIC!
A Loader with a Mechanical Brain!

SELF-STOPPING

SELF-LEVELING

SELF-STARTING

New, revolutionary loading platform automatically carries loads from loading dock to truck floor, whether truck is above or below dock. Can also be installed at ground level. Motion controlled by switch bar in platform and by self-leveling ramp. Human element eliminated! No hand switches! Exact levels! Models 6000 to 20,000 lbs. Write for descriptive literature.

LOAD-O-MATIC*
* Pat. App. for

FIELD ENGINEERING CO., 66 Foote Ave., Jamestown, N.Y.

Push Bakery-Product Tax To Defray Farm Support

A tax on bread and other bakery goods—as a way to pay for a two-price farm support program—is reported to be gaining strength in Washington.

In this plan, which might be considered a revival of the McNary-Haugen idea proposed in the '20's, the farmer would get a government check to make up for the difference between the free market price for his wheat and 100% of parity.

Recommended by Secretary Benson's Wheat Advisory Committee as well as House Agriculture Chairman Hope, the program's points are being outlined by government spokesmen contacting farmers in the wheat area. Though the idea of "government-check subsidizing" is subject to disfavor, still this would remove the necessity of rigid production controls for which the farmer also has no liking.

The direct tax would fall on processors and millers. The farmer would sell his entire wheat output on the open market, but would be given "certificates" guaranteeing him a 100% parity price on his share of the domestic consumption. The processors eventually would have to buy certificates and pass the cost on to consumers.

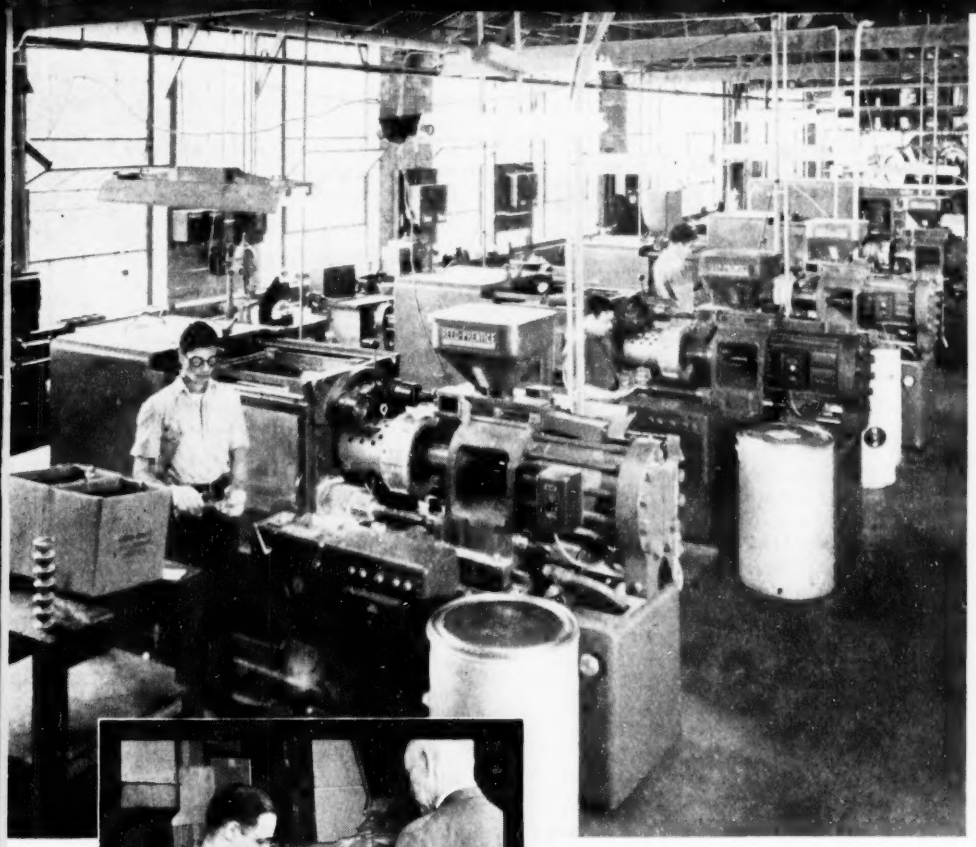
Moisture Content Gaged By Magnetic-Field Unit

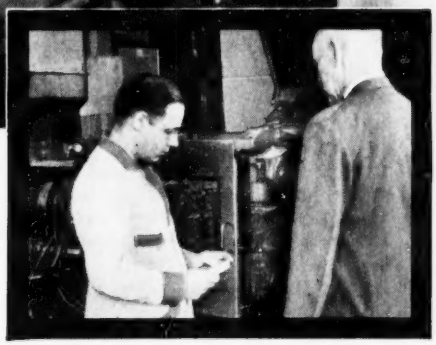
Quick checks of moisture content of fruits, vegetables, and other foods, are reported achieved with a measuring instrument comprising a permanent magnet coupled with a radio-frequency spectrometer.

The new method, being explored by T. Shaw and R. Elsken of Western Regional Research Laboratory, Albany, Calif., may take the place of the common "weigh, dry, and weigh" technique, which is much slower and may alter materials being checked.

After the magnet has set up a magnetic field, the food sample is put under an oscillating electro-magnetic field produced by the spectrometer. Then protons in the nuclei of hydrogen atoms in the sample absorb energy from the oscillating field, and this absorption is gaged by the spectrometer. Thus there is a measurement of amount of moisture in the sample, since more energy is absorbed by protons occurring in a liquid than in a solid.

Apples, proteins, potatoes, starch, and pectin are typical of foods already checked satisfactorily with the device. However, precision has thus far been





Despite cleanliness and efficiency of a midwest firm's Plastic Division, shown above, there was "dirty work" afoot in the hydraulic systems of the injection molding machines. Division superintendent (left) and A. L. Seabaugh, of Standard Oil, came up with a solution.

Stops "dirty work" in hydraulic units

● A midwest company became increasingly aware that hydraulic oil performance in its fourteen injection molding machines was not all that it should be. Formation of oil deposits not only made frequent cleaning of filters necessary but posed a threat to efficient operation of the hydraulic units.

A Standard Oil lubrication specialist recommended STANOIL Industrial Oil, a top quality product of exceptionally high stability and containing necessary additives to prevent corrosion and oxidation troubles.

Throughout six years of continuous hard use, STANOIL has provided clean operation. It has not been necessary to replace any of the original fills of STANOIL, and only a small amount of make-up oil has been needed. Where filters previously had to be cleaned at least four times a year, they are now cleaned once each year. Hydraulic operation has been efficient and reliable.

STANOIL
TRADE MARK
Industrial Oil

You can rely on STANOIL to give you the same clean, dependable service not only in hydraulic units but in a wide variety of equipment. You can get the help of the Standard Oil lubrication specialist serving your section of the Midwest by phoning your local Standard Oil office. Or, write: Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

What's YOUR problem?

A. L. Seabaugh, working out of Standard's Chicago office, is the lubrication specialist who helped this midwest firm gain both operating and maintenance benefits through use of STANOIL in hydraulic units.

Located throughout the Midwest is a corps of specially trained, experienced Standard Oil lubrication specialists, ready to give you prompt, on-the-spot help with lubrication in your plant. Their broad background of practical experience, plus their thorough training in Standard Oil Lubrication Engineering Schools, is yours for the asking. Simply phone your nearest Standard Oil Company office. The lubrication specialist will call without delay. He has a complete line of petroleum products to offer, including such outstanding lubricants as:

SUPERLA Greases — Available in a wide range of consistency grades and in both lime-soap and soda-soap types. SUPERLA Greases cover a wide range of operations. These efficient products are comparable in quality with the highest type of special greases.

STANOLITH Greases — Because these unique lithium soap products possess the heat resistant properties of soda-soap greases and the water resistant properties of lime-soap greases, they offer a solution to lubrication problems caused by the presence of both heat and water.

STANDARD OIL COMPANY

STANDARD (Indiana)

Depend On Morningstar For Food Starches And Thickening Agents

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POTATO STARCH
ARROWROOT FLOUR
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STARCHES & DEXTRINES
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MORE and more Food Product Processors are depending upon us for Food Starches and Thickening Agents. Direct importers and manufacturers, we can ship quickly and economically in any quantities from a few 100 pound paper bags to many carloads. MORNINGSTAR Products are scientifically prepared and laboratory controlled to precise standards of *uniform* fine quality. They'll add new appeal to many foods. MORNINGSTAR, NICOL, INC., 640 West 51st Street, New York 19, New York; 1780 Canalport Avenue, Chicago 16, Illinois.

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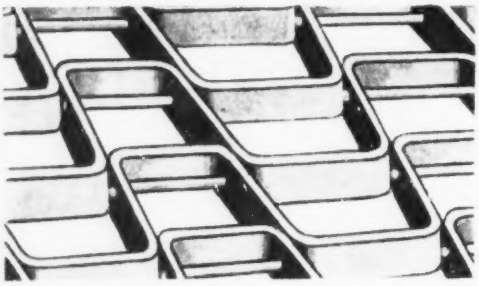
Scientific Starch, Dextrine and Natural Gum Service

you SAVE

on every food handling operation with



LA PORTE
FLEXIBLE STEEL CONVEYOR BELTING

Every step of the way in food processing, packing and shipping, LA PORTE Flexible Steel Conveyor Belting is serving efficiently at lower cost. It will withstand impacts at the loading chute. It resists cold. It requires no dressing or special maintenance to keep it at peak efficiency.

La Porte Belting flexes to grip the friction drum firmly—eliminating all creeping, weaving or jumping. Thus, it provides a perfectly flat surface for containers empty or filled. The open mesh feature that permits circulation of air or liquids around products in process also simplifies sterilizing with a steam gun or scalding water. Available in any length and practically any width.

Ask your dealer for literature and prices or write to:

LA PORTE MAT & MFG. CO.
BOX 124 LA PORTE, INDIANA

limited to small samples such as .5 cc. Further, the unit has lacked capacity to distinguish between water and oil. However, improvements are looked for in the course of the work.

New Lightest Skyscraper Has Reversible Windows

An impressive saving in structural steel framing—bringing weight down 30 to 50 percent under that required for conventional masonry buildings—distinguishes the new 30-story skyscraper erected in Pittsburgh by the Aluminum Co. of America.

The trick was turned by use of exterior "curtain" walling comprising hundreds of 6x12-ft. aluminum panels.

Further notable in this "lightest skyscraper ever built" are special 4-ft.-square aluminum windows that are reversible, thus enabling safe cleaning from within the building. Incorporated in these units are rubber-tube gaskets to keep weather out. Window cleaners' carts carry air compressors to inflate tubes for sealed closure.

Completely air conditioned, the Alcoa Building's offices are radiantly heated as well as cooled by water piping installed in the aluminum ceilings. Strikingly, all electric wiring and most of the plumbing units are aluminum. So, too, are lighting fixtures, elevator cabs, partition framing, and extensive interior trim.

New building was constructed by George A. Fuller Co., N.Y.C. and Pittsburgh. Designer was Harrison & Abramovitz, N.Y.C. Assisting in the design were two Pittsburgh architectural firms—Mitchell & Ritchey and Altenhof & Bown.

"Listens" for Insects

There may soon be rapid detection of insect infestation of grains in storage—through use of an electronic device that "listens" for larvae hidden in the kernels.

Consisting of a low noise-level audio amplifier and a microphone and loudspeaker, the system receives the sound of insect larvae and pupae as they move and feed inside grain kernels placed in a soundproof box. An oscillograph can be employed to record the sound patterns.

Envisioned are special applications in connection with large storage bins wherein constant checks would be enabled by a permanent set up similar to that of thermocouples that give continuing checks on temperature.

The "listener" is a development of Drs. R. Adams, J. Wolfe, M. Milner, and J. Shellenberger of Kansas State College.

Schoettle Case Histories:

true story of a

Purchasing Agent Up a Tree

CASE HISTORY #31 Wow! Friday! Someone suddenly discovers inventory on a very important box is down to zero—and Monday's deliveries depend upon these boxes! Frantically, wires burn to the Schoettle plant. Purchasing agent says he's "up a tree" and we have to get him out! . . . our customer* for 17 years . . . practically out of business without boxes, etc., etc. Schoettle goes to work . . . cardboard made that night . . . men and machines hum 'round the clock Saturday and Sunday. Monday, we deliver 2-color boxes. Ask *that* P A about Schoettle!

CASE HISTORY #23 Here's a case where Schoettle took a Purchasing Agent "out of a tree" and put a halo on his head! Company* needed a carrier-pack to hold 3, 4, 6 cans for multiple sales. Nine competing companies submitted suggestions . . . all N.G.! Schoettle made a thorough study of the field . . . devised a smart new construction . . . turned it over to the P A. Purchasing Agent got some mighty kind words from Board of Directors . . . Schoettle got the order. P.S.: Schoettle thrives on anonymity and reflected glory . . . and good paper boxes delivered on time!

Schoettle customers are seldom "up a tree" for paper boxes because Schoettle goes to town for its customers! Inventory slip-ups, sudden orders, sometimes cause major Purchasing Agent headaches. Schoettle has the remedy . . . quality paper boxes delivered ON TIME!

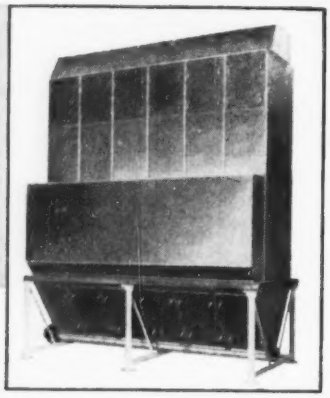
*name on request

EDWIN J. SCHOETTLE CO.

533 NORTH ELEVENTH STREET • PHILADELPHIA 23, PENNA.

Designers and Manufacturers of Paper Boxes with Buy Appeal

ALL ALUMINUM CONSTRUCTION...



Simplified Modern Design

For efficient dust control, let us design your exhaust system incorporating the all-aluminum Simon Suction Filter Dust Collector!

A truly modern dust collector . . . it assures high air to cloth ratios . . . long filter cloth life . . . ease of cleaning and minimum maintenance. Each filter sleeve group is automatically cleaned, maintaining UNIFORM AIR FLOW at all times.

A Simon Suction Type Filter Costs No More Than A Pressure Type Unit.

The trademark "ENTOLETER" is your guarantee of complete satisfaction.

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P.O. BOX 904—NEW HAVEN 4, CONN.

Another **VIKING** *"Sanitor"*

Equipped **FARM TANK TRUCK**

Photo Courtesy of Walker Stainless Equipment Co.

WHY?

- Because the Viking "Sanitor" mounts so easy in rear compartment.
- Port locations and ease of changing make handy hose connections.
- Slow speeds and positive action assures smooth transfer of all the milk from tank cooler.
- Weight of unit cut a 100 100 lbs. from other conventional units.
- 3A approved construction, simple O-Ring seal, solid dairy metal pump.

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VIKING PUMP COMPANY
CEDAR FALLS, IOWA

What Other Fellow Does

On finding that more than half of their employees knew little about plant operations beyond their own specific duties, executives of Garrett & Co., Brooklyn winery, set about teaching them. Here at open house, expert winemaker, A. Tirico (center) explains to workers, their families, and friends the firm's methods of ageing and racking wines. This was just one stop on comprehensive plant tour.

Bacteria Fighter in Wine

An investigation of the wine process has led to isolation of an antibacterial substance from red wine fermented two to six weeks.

As yet not named, the substance is capable of inhibiting, in the test tube, four representative types of bacteria: *Escherichia coli, staphylococcus aureus, bacillus megatherium,* and *pseudomonas aeruginosa.* The curbing action thus far attained is weak in comparison to that of penicillin. However, further refinement may increase the strength.

For initiating these studies, John Gardner, a senior pharmacy student at the University of California, has received the American Pharmaceutical Assn.'s Kilmer Prize. He launched his work after noting that soldiers of ancient armies appeared to be less subject to intestinal troubles when they drank wine.

Sulfur-Spotting "Nose"

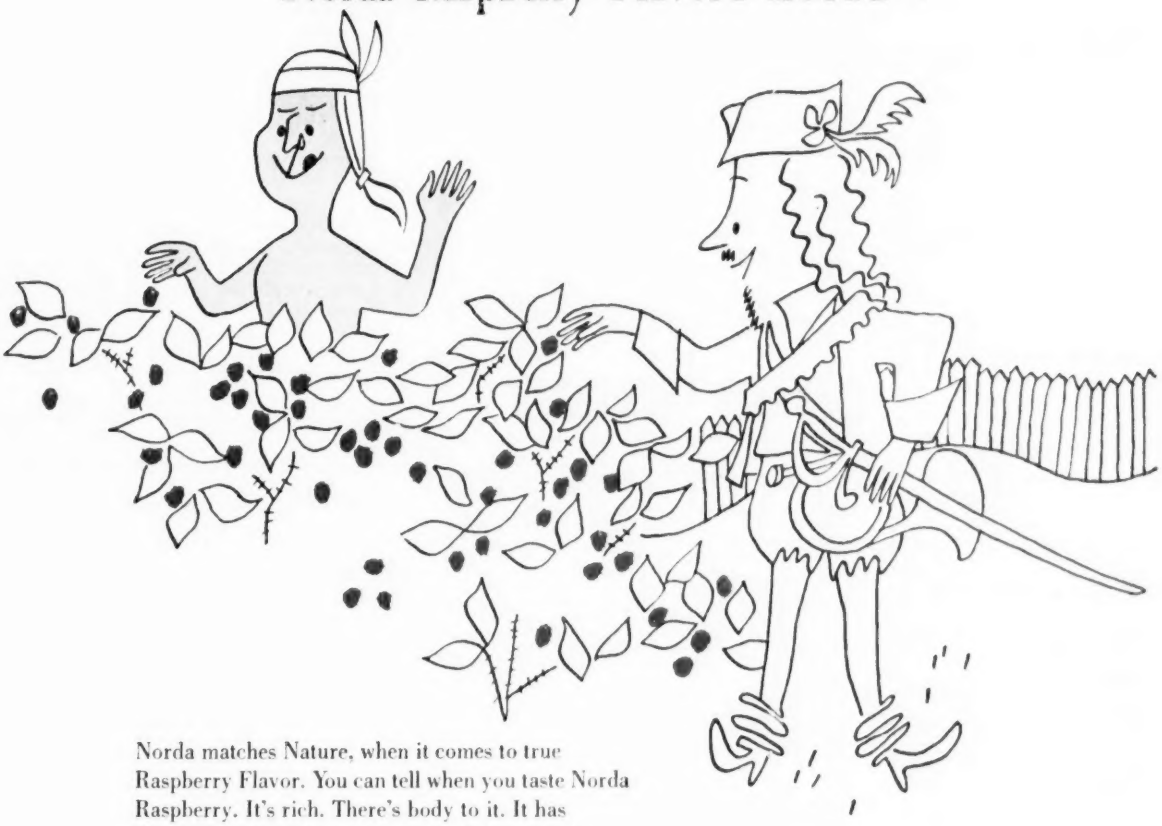
Odor research and air pollution studies are seen sped by a newly developed "electronic nose" called the Tritilog.

It is stated that this device can discern sulfur in concentrations as low as ⅛ ppm. and can record in 20-30 sec. any changes in the concentrations.

Operation is based on titration with bromine, which is generated electrically (as required) in the solution in which sulfur compounds are absorbed. A meter records generating current, which is always proportional to sulfur concentration.

Description of the instrument was contained in the paper by H. Landsberg and E. E. Escher of Consolidated

It's said that in 1696,
The Raspberry first was found;
People seem a lot happier now:
Norda Raspberry Flavor's around



Norda matches Nature, when it comes to true Raspberry Flavor. You can tell when you taste Norda Raspberry. It's rich. There's body to it. It has the same real raspberry character that makes the fresh fruit so fine.

Norda makes both genuine natural and imitation red and black raspberry flavors. They have the characteristics of the actual fruit. Their concentrated richness is true-to-life. Their strength saves money for you.

Improve the quality, aroma, tastiness, and popularity of your ices, gelatins, fondants, syrups, and mixes by using Norda Raspberry Flavor. See how much you will improve them by testing and tasting the generous free samples we hope you will send for *today*.

Use "A Favorite to Flavor It"... A Norda Flavor

Norda

ESSENTIAL OIL AND CHEMICAL COMPANY, INC.
601 West 26th Street, New York 1, N. Y.

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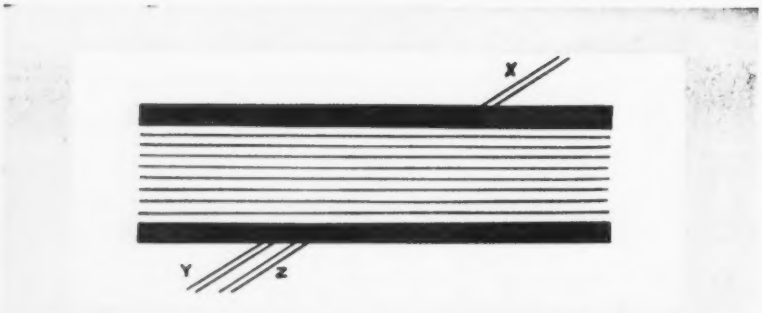

Which is the straight line, XY or XZ?

Things don't always turn out to be *the way they appear*. Realizing this, leading food processors *test* with COOK-CHEX quality control tags.

And unless the purple spot on the tag has changed to green, they *know* that bacteria aren't completely destroyed. Write today for a free supply of COOK-CHEX, stating the time and temperature of your processes.

See for yourself how COOK-CHEX save time, save money, and insure your good name with consumers by eliminating the possibility of flat sours and blown cans.

Remember, things don't always turn out to be *the way they appear!*

ATI COOK·CHEX

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This year it's in

Philadelphia

24TH EXPOSITION OF CHEMICAL INDUSTRIES
ESTABLISHED 1915
NOV. 30 to DEC. 5
COMMERCIAL MUSEUM AND CONVENTION HALL

Meet and discuss your processing problems with leading technical men of the almost 500 progressive firms in this timely exhibit. Avail yourself of their talents and techniques. Get tailored solutions to your plant problems.

See and compare the newest equipment, from delicate instruments up to large industrial units.

One good idea alone will repay you for the time spent at this great exposition.

PLAN NOW TO ATTEND.

Application forms for hotel accommodations are available by writing to
INTERNATIONAL EXPOSITION COMPANY • 480 LEXINGTON AVENUE, NEW YORK 17, N. Y.

Engineering Corp., Pasadena, Calif., presented before the recent Chicago meeting of the American Chemical Society.

Briefly . . .

• A "NUTRITION Educational Foundation," conducted along the lines of the Nutrition Foundation, is proposed by Dr. H. E. Robinson, director, Swift & Company Laboratories, as a means of promoting proper eating for maximum health while combatting growing reducing-fad excesses leading to poor nutrition.

• **BEEF consumption this year in the U. S. may equal or even possibly surpass the per capita record of 73 lb. chalked up in 1909, say USDA economists.**

• **SUCROSE** has finally been made synthetically, thus providing valuable data on the natural process. Futilely sought by researchers for many decades, the goal was won by Drs. Raymond Lemieux and George Huber, of the National Research Council of Canada, after persistent molecular-structure trials.

• **GEORGIA UP: Between 1939 and 1951, number of Georgia food plants rose 20 percent and value of processed food products 400 percent, reports the state's department of commerce. Plants climbed from 631 to 756 and the dollar values from $134 million to $809 million.**

• WELDING INGENUITY of your workers is their ticket to try for awards in new $13,500 competition announced by The James F. Lincoln Arc Welding Foundation, Cleveland. Specifically eligible are employees in bakeries, confectioneries, bottling plants, breweries, canneries, cold storage locker plants, flour mills, dairy-cheese-ice cream plants, grain elevators, and meat packing establishments. Called for are descriptions of use or possible use of arc welding in maintenance, operation, or services of such plants. Rules are available from Foundation.

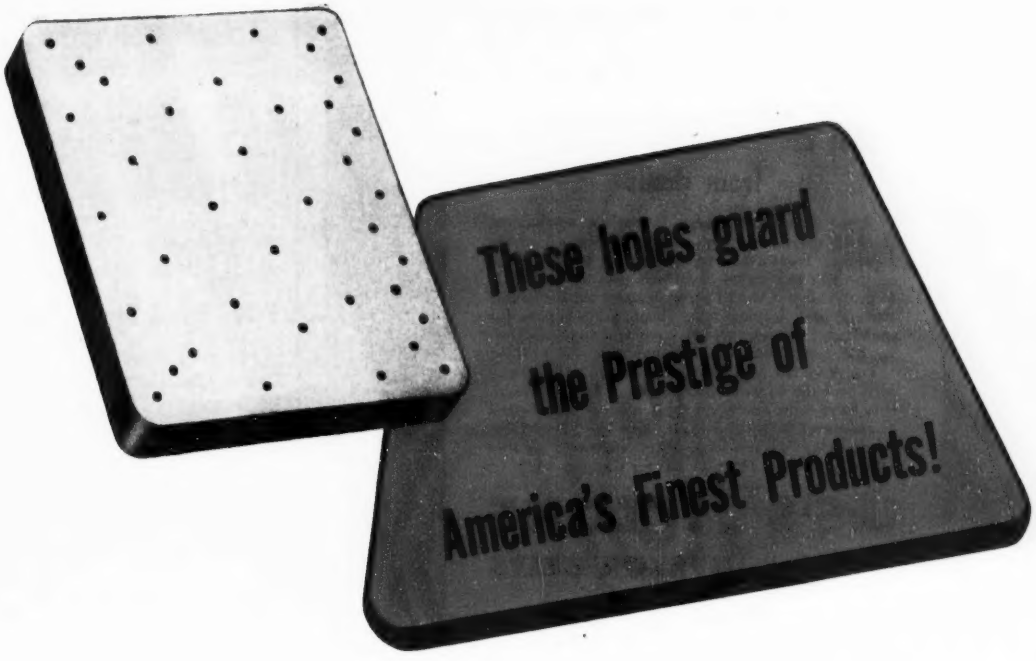
• **MILK BUYING has changed sharply, according to figures cited by V. K. Shuttleworth of American Can Co. Whereas 95 percent of all packaged milk was delivered to home in early '30s, today less than 45 percent is toted to doorstep by milkmen.**

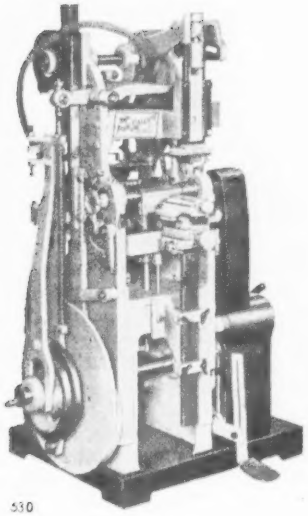
• **REINDEER MEAT will be stored in**

Corrections

On p. 86, Sept. FE, following line was inadvertently omitted from top of 1st column: "-chanical brain' but for han-"

On p. 112, same issue: Beginning with 2nd complete paragraph, right-hand column should have been printed directly following 2nd-column head "Electrostatic Smoking."





530

HOW? By utilizing *vacuum* in a critical stage of your packaging.

All the care lavished on selecting appropriate containers, perfect closures and attractive labels for carefully made products,—the components that reflect Quality, can be nullified by neglecting precision labeling.

When your product meets the eye of the buyer, every label should be exactly in its proper position,—in intimate *permanent* contact with its container. This is *mechanically assured* by use of vacuum to do the label-handling, guaranteeing positive label-feeding, uniform adhesion and accurate label placement.

To do this, you need a PONY LABELRITE®

Why not ask for proof?

NEW JERSEY MACHINE *Corporation*

AUTOMATIC LABELING • PACKAGING — PAPER BOX MACHINERY • MAKERS OF THE PONY LABELRITE

FACTORY SALES AND SERVICE BRANCHES
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MAIN OFFICE & FACTORY: 1500 WILLOW AVENUE, HOBOKEN, N. J.

For more information, use coupon on page 207.

Nut meats rapidly separated from shells

• After nuts have passed through a mechanical cracking operation, they are carried via a Cyclone Equalized Weave Belt to the packing tables. While on the belt nut meats and shells pass under a battery of vacuum throats that remove all shells and other debris, leaving only clean, perfect nuts for packaging. An impractical, cost- and time-consuming hand operation was eliminated.

You may not process nut meats . . . or have any such problem in your food plant . . . but you probably have some operation that could be modernized or improved with the use of a Cyclone Metal Conveyor Belt. Ask our experienced engineers for free advice, and write Dept. H-103 for Catalog 84.

U·S·S CYCLONE
METAL CONVEYOR BELTS

CYCLONE FENCE DEPARTMENT
AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION
WAUKEGAN, ILLINOIS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

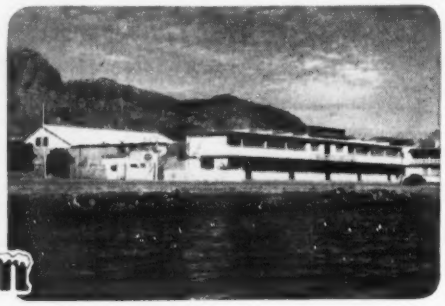
USS

UNITED STATES STEEL

And in Mexico -

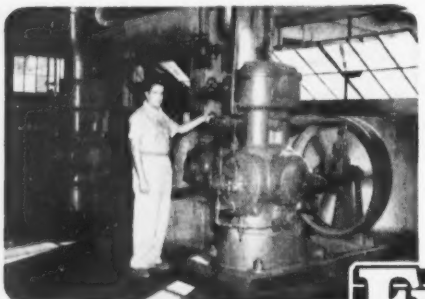
FRICK

Refrigeration



Freezes 11 tons of shrimp, stores 50 tons, and makes 15 tons of ice daily for the Mariscos Congelados del Pacifico, S.A., at Guaymas, Sonora. This is one of the many ice plants, breweries, quick-freezers, dairies, packing houses, cold storages, hotels and restaurants in Mexico which find Frick refrigeration and air conditioning the ultimate answer to their cooling problems.

Let us quote NOW on the cooling system YOU need.



Two Frick 7" x 7" Compressors in Service at Guaymas

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.

quantity in refrigeration plants planned by Canada at Oklavik and Fort Smith, Northwest Territories.

• FROZEN-JUICE per-capita consumption is forecast as headed toward another record-breaking year. Possibilities are high that 1953 purchases of frozen concentrated orange juice will outrun production by perhaps 10 percent, bringing a dip into the adequate reserve supplies.

FDA Food Standards

Status of food standards of Food & Drug Administration in mid-September is reviewed below:

Policy Statement: "Separate treatment is justified for pesticides as distinguished from other types of chemical food additives." So declared Deputy Commissioner Larrick to the National Agricultural Chemicals Assn. on Sept. 11. Coordination of the USDA-administered Pesticide Act and the FDA-administered Food & Drug Act is also believed desirable.

In the same address, Mr. Larrick submitted for NACA's consideration "the proposition that reasonable fees should be charged sufficient to enable us to provide, equip, and maintain an adequate and efficient organization for passing upon the sufficiency of the submitted evidence and otherwise carrying out the provisions of whatever legislation in this field is enacted."

Future Hearings: 1. Pacific oysters, amendment, standard of identity. Reduction in number of sizes (from 6 to 4) and adoption of new size names (large, medium, small, and extra small) are major objectives. Hearing scheduled for Oct. 21, with formal announcement expected momentarily.

2. Salad dressing, rehearing (ordered Mar. 1951 by 3rd Circuit Court of Appeals), standard of identity; "skim milk and milk products", proposed as optional ingredients. FDA gathering data; no hearing date set yet.

3. Process cheese food, amendment (requested by manufacturers in early 1951), standard of identity; skim milk cheese proposed as optional ingredient. Hearing expected soon, but date not set yet. Hearings probably will include discussion of antimycoctic agents, both intentional and incidental .

4. Canned tuna, new, standards of identity and fill. Hearing expected soon, but no date set yet; initiative of Secretary.

5. Catsup, amendments, standard of identity. National Canners Assn. has requested additional of corn syrup as an optional ingredient; hearing announcement expected soon.

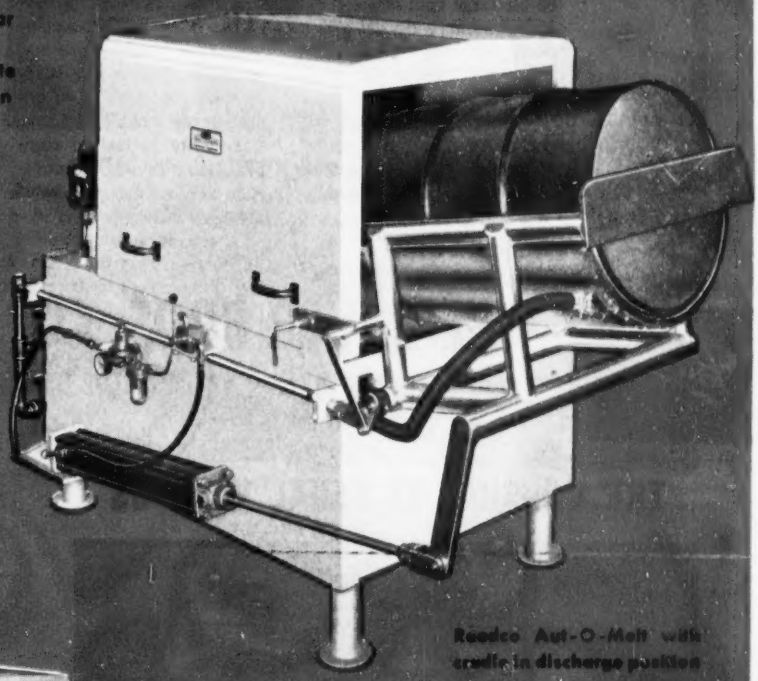
Other commodities on FDA sched-

To the Baker who would rather use his head than his back

A Readco Aut-O-Melt, installed near your shortening storage area, will dump, melt and accurately distribute shortening to your dough mixer, pan greaser and other equipment in less time—with less waste, cost and effort.

The Aut-O-Melt is safe. Its steam-heated cradle and coils eliminate fire hazards which result from overheated or shorted electrical elements. Charring or burning of shortening on the heating elements does not occur.

Shortening is maintained at the proper temperature throughout the complete system by thermostatically controlled, heated pipes. The walls of the shortening drum are heated by the cradle to minimize waste.



Readco Aut-O-Melt with cradle in discharge position

Readco Aut-O-Melt with cradle in loading position

The Aut-O-Melt is accurate. From the mixing platform, the operator accurately controls the flow of shortening to any one of a series of mixers and observes meter recordings of the exact quantities of shortening delivered.

The Aut-O-Melt is sanitary. The entire system can be cleaned and drained through a single valve. Fine mesh, stainless steel screen safeguards shortening against foreign materials at two points in the system.

For further information, call your nearby Readco Representative, or write the Read Standard Corporation, York, Pennsylvania.

READ STANDARD
CORPORATION

Bakery-Chemical Division: York, Pennsylvania
Los Angeles 39, California

For more information, use coupon on page 207.

WHAT'S YOUR *GRINDING PROBLEM?*

If you're wondering how to crush, granulate, or pulverize some kind of material, maybe the same kind of a job or a similar one is already being done with our machines. Then the answer to your question is easy.

However, you may have an entirely new grinding problem. If so, we'd like to find the answer in our research and testing laboratories.

The functions of these laboratories are to conduct and evaluate pilot tests on materials in behalf of processors; to make short production runs on commercial-size machines; to develop and adapt machines for heretofore untried processess.

You are invited to communicate with us. Our knowledge and facilities may be of great value to you.

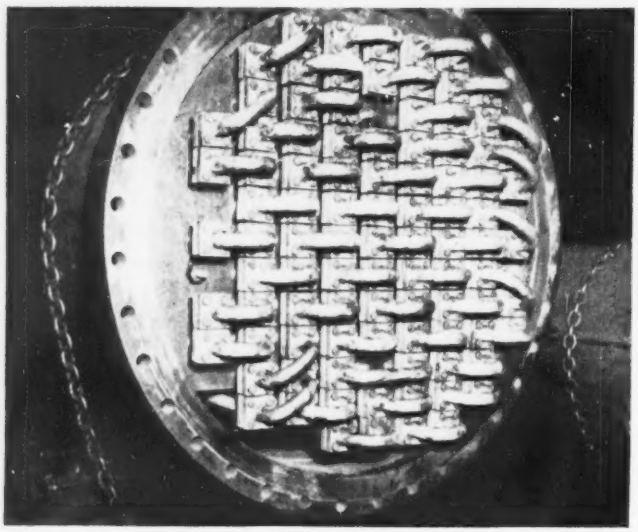
Bauer

THE BAUER BROS. CO.

1740 SHERDIAN AVE. • SPRINGFIELD, OHIO

Established 1878

THE UNUSUAL IS USUAL WITH US



One of four 42" x 20' Heat Exchangers with *special design* Return Bend Flanges . . . produced by DOWNINGTON'S Heat Transfer Division. Useful literature gladly sent upon request. Remember: "your needs are our specialty"!

New York Offices: 30 Church St.

DOWNINGTON IRON WORKS INC

DOWNINGTOWN IRON WORKS, INC.

DOWNINGTOWN-PENNA.

DIVISION OF PRESSED STEEL TANK COMPANY

Hackney

STEEL AND ALLOY PLATE FABRICATION AND HEAT EXCHANGERS

ule will probably be delayed somewhat by reduced appropriations for current fiscal year.

Hearings in Progress: None.

Tentative Orders Awaited: 1. Residue tolerances, on fresh fruits and vegetables, new. Expected soon; hearing adjourned Sept. 1950; briefs filed Dec. 1950.

2. Canned pineapple and canned pineapple juice, new, standards of identity, quality, and fill. Expected momentarily; hearing adjourned in Apr. 1952; briefs were filed in Sept. 1952.

3. Ice cream, new, standard of identity. Not expected soon; hearing adjourned in December; briefs due on Sept. 17; extended (p. 5331, Sept. 2 *Federal Register*) from Aug. 31, date last announced.

4. Cacao products, amendment, standard of identity. Expected soon; hearing held Sept. 15; briefs due Oct. 15. No witness appeared to object to FDA proposal that coumarin be deleted as an optional ingredient.

Final Order Awaited: Frozen fruits, new, standards of identity and fill. Expected momentarily; tentative order published in Oct. 1950; exceptions filed in Jan. 1951.

Standards Completed: None since canned mushrooms amendment, reported in Oct. 1952, p. 207.

USDA Grade Standards

Recent actions by Production & Marketing Administration of USDA on U. S. Grade Standards and related activities include the following:

List of U. S. Standards for grades of processed fruits and vegetables (canned, dried, and frozen) as of Aug. 31 has been released by PMA.

Lentils, amended, p. 4055, July 11 *Federal Register*, effective Aug. 1.

Tomato sauce, proposed, time for written comments extended from June 28 to Dec. 31 by notice on p. 4199, July 17 *Federal Register* (original proposal p. 3096, May 29 *Fed. Reg.*).

Cottonseed for crushing, "proposed amendment will not be made effective", p. 4380, July 25 *Federal Register*.

Tomato catsup, third revision, p. 4443, July 30 *Federal Register*, effective Aug. 29.

Grapes, sawdust pack (*European or Vinifera type*), revised, proposed, p. 4462, July 30 *Federal Register*, written comments received until Aug. 29.

Canned fruit cocktail, revised, p. 4512, Aug. 1 *Federal Register*, effective Aug. 6.

Fresh tomatoes, revised, p. 4880, Aug. 15 *Federal Register*, effective Sept. 14.

Eggplant, revised, proposed, p.

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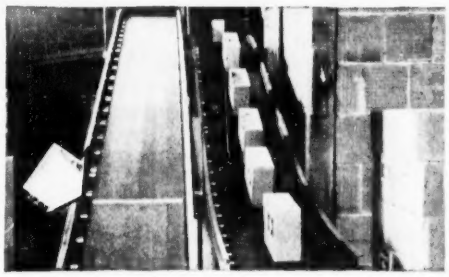

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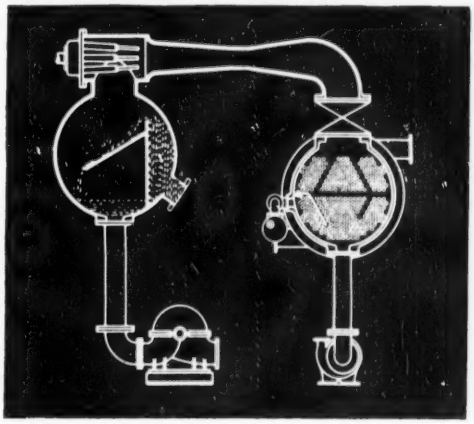

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4894, Aug. 15 *Federal Register*, written comments received until Sept. 14.

Frozen concentrate for lemonade, new, proposed, p. 4996, Aug. 21 *Federal Register*, written comments received until Sept. 20.

Cucumbers, revised, proposed, p. 5299, Sept. 2 *Federal Register*, written comments received until Oct. 2.

Frozen cooked squash, new, p. 5364, Sept. 4 *Federal Register*, effective Oct. 4.

Peeled white potatoes, new, proposed, p. 5389, Sept. 5 *Federal Register*, written comments received until Oct. 5.

Schedule of Events

October

10–17—International Dairy Show (Chicago Farmers Club); International Amphitheater, Chicago.
11–13—Brewers' Assn. of America, annual convention & exhibit; Edgewater Beach Hotel, Chicago.
12–14—Packaging Institute, annual forum; Hotel Statler, New York City.
18–20—National Pretzel Bakers Institute; Claridge Hotel, Atlantic City, N. J.
19–23—Master Brewers Assn. of America, annual convention, and International Brewing Industries Exposition; Kiel Auditorium, St. Louis, Mo.
18–24—Industrial Packaging & Material Handling Exhibition; Mechanics Hall, Boston.
24–28—American Bakers Assn., annual meeting, Hotel Sherman, Chicago.
26–27—National Pickle Packers Assn., annual meeting; Drake Hotel, Chicago.
26–28—Milk Industry Foundation, convention; Sheraton Plaza Hotel, Boston.
28–30—International Assn. of Ice Cream Manufacturers, annual convention; Statler Hotel, Boston.

November

2–4—American Oil Chemists' Society, Fall meeting; Sherman Hotel, Chicago.
3–5—Packaging Assn. of Canada, annual convention, and Canadian National Packaging Exposition; Canadian National Exposition Bldg., Toronto, Ont.
3–11—First International Dairy Equipment Exposition; Parc des Expositions, Porte de Versailles, France.
8–12—National Milk Producers Federation, annual convention; Rice Hotel, Houston, Tex.
9–11—Grocery Manufacturers of America; Waldorf-Astoria Hotel, N. Y. C.
9–12—American Bottlers of Carbonated Beverages and International Beverage Exposition; Chicago.
9–12—Refrigeration & Air Conditioning Exposition; Public Auditorium, Cleveland.
11–13—Assn. of Food Industry Sanitarians, annual meeting and conference; Claremont Hotel, Berkeley, Calif.
20–21—Dairy Industries Society, International, World Congress for Milk Utilization; Statler Hotel, Washington, D. C.
30–D5—Exposition of Chemical Industries; Commercial Museum & Convention Hall, Philadelphia.

December

6–8—Chemical Specialties Manufacturers Assn., annual meeting; Mayflower Hotel, Washington, D. C.

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PRODUCTS

Modified Locust Bean Gum, Solution Thereof, and Process for Making Same—*N. Frisch, White Plains, and F. J. Sweeney, Forest Hills, N. Y. to Stein, Hall & Co., Inc., New York.* No's. 2,644,762-65. *July 7, 1953.*

Therapeutic Fat Product Consisting of Edible Vegetable Oil Suspended in Sugar Solution by Stabilizer—*L. W. Wachtl and C. E. Meyer to The Upjohn Co., Kalamazoo, Mich.* No. 2,646,354. *July 21, 1953.*

Foodstuff Composition of Enhanced Whiteness Consisting of Carbohydrate With Coumarin-Type Additive—*H. H. Zweifel and F. Ackermann, Binningen, Switzerland to Ciba Ltd., Basil, Switzerland.* No. 2,646,355. *July 21, 1953.*

PROCESSES

Refining Starch Suspension By Continuously Feeding Into High-Velocity Inwardly-Tapered Enclosure Under Pressure, Thus Separating Particles According to Size at Infeed and Outfeed Ends—*F. J. Fonteim, Heerlen, Netherlands to Stamicarbon N. V., Heerlen.* No. 2,642,185. *June 16, 1953.*

Canning Whole Fresh Milk by Pasteurizing, Homogenizing, Filling Into Sterile Cans, Sealing, Heat Treating to 240 deg. F. Within 10 min., Holding 14 Min., Cooling—*J. C. Moeri, New Orleans, La. to Farm Fresh Milk Corp., Miami, Fla.* No. 2,642,363. *June 16, 1953.*

Continuously Hydrogenating Reducible Sugar to Polyhydric Alcohol By Adding Catalyst and Feeding Hydrogen at Fixed Pressure, Temperature, and Rate—*L. Kaschagen, West Chester, Pa. to Atlas Powder Co., Wilmington, Del.* No. 2,642,462. *June 16, 1953.*

EQUIPMENT

Egg Washing Machine Employing Plurality of Cooperating Rotating Spools With Extending Resilent Scrubbing Fingers and Directed Spray—*G. W. Johnson, Raytown, Mo. to Gordon W. Johnson Co., Kansas City, Mo.* No. 2,640,209. *June 2, 1953.*

Egg Washing Machine Utilizing Endless Conveyor and Washing Trough With Means for Rotating Eggs—*O. Zauner, Vineland, N. J.* No. 2, 640,210. *June 2, 1953.*

Smokehouse With Distributing Ducts Fed by Roofborne Receiver Unit for Generated Smoke and Other Fluids With Means for Heating Such Fluids and Spark Control—*C. B. Jensen, to Atmos Corp., Chicago.* No. 2,640,414. *June 2, 1953.*

Continuous Strip Cutter for Beltborne Candy Employing Series of Rotary Knives and Belts Discharging to Solid Drum Conveyor—*R. F. Morrison, Oak Park, Ill. to Mars Inc., Chicago.* No. 2,640,446. *June 2, 1953.*

Chitterling Preparing Machine Employing Wheel-Equipped Mandrel to Retain and Move Casings Plus Cutting Means—*O. A. Clemens and R. O. Mertens, Chicago, and M. Waickhof, Villa Park, Ill. to Swift & Co., Chicago.* No. 2,641,020. *June 9, 1953.*

Continuous Sterilizer for Canned Foods Comprising Trough Containing Steam Heated Mineral Oil Bath and Can Conveyor—*E. N. Higgins, Emsworth, and V. P. Evans, McKees Rocks, Pa. to H. J. Heinz Co., Pittsburgh,* No. 2,641,176. *June 9, 1953.*

Molding Apparatus for Manufacturing Assimilated Shrimp From Shredded Shrimp Meat—*A. E. Waltman, Pass Christian, Miss.* 4 *to E. P. Guice,* 4 *to Eldon E. Hickey, Ocean Springs, Miss.* No. 2,641,797. *June 16, 1953.*

Sausage Linking Machine Employing Rotating Twisting Head With Linking Holder Having Grippers Moving in Reciprocation With Casing—*E. W. Anderson, Chicago.* No. 2,641,798. *June 16, 1953.*

Apparatus for Injecting Cure Into Hog Bellies and Like Utilizing Series of Laterally Spaced Hollow Injecting Needles With Downward and Forward Movement to Engage Meat Passing on Belt Below—*N. J. Allbright and R. W. Illsley, to The Allbright-Nell Co., Chicago.* No. 2,641,990. *June 16, 1953.*

Machine for Continuously Depositing Candy Centers Into Plurality of Mold Cavities—*C. R. Zimmer, to E. J. Brach & Sons, Chicago.* No. 2,642,010. *June 16, 1953.*

Bread Molding Machine With Means for Curling Pieces of Sheeted Dough On Themselves—*M. A. Stickelber, to Stickelber & Sons, Inc., Kansas City, Mo.* No. 2,642,012. *June 16, 1953.*

Dough-Web Forming Machine Employing Hopper Feeding Parallel Spaced Rollers—*E. M. Crosland, Culcheth near Warrington, and J. F. Naylor, Newton-le-Willows, England to T. & T. Vicars Ltd., Earlestown, Newton-le-Willows, England.* No. 2,642,014. *June 16, 1953.*

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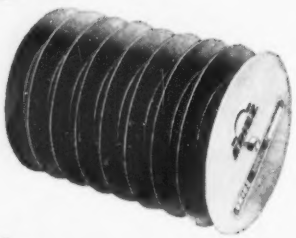

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D. W. Enoch, to Interstate Bakeries Corp., Kansas City, Mo.—No. 2,642,031. June 16, 1953.

Fowl Scalding Machine Comprising Elongated Chamber With Suspended Reticulated Oscillating Receptacle—*Z. Stubelek, Southampton, N. Y. No. 2,642,618. June 23, 1953.*

Meat Skinning Machine Fed by Endless Conveyor That Permits Meat Rotation as Skin Is Held by Clamping Jaws—*F. J. Coad (deceased), by Mrs. Coad, Des Moines, Ia. to Swift & Co., Chicago. No. 2,642,619. June 23, 1953.*

Apparatus for Continuously Heating and/or Cooling Canned Foods Employing Series of Vertically-Spaced Parallel Tilting Can Guideways—*D. W. Bingham, Brighton, Victoria, Australia. No. 2,642,795. June 23, 1953.*

Cheese Press Comprising Table-Borne Trough With Lengthwise Spaced Aligned Openings in Top, Suspended Backing Plate, and Ram Cooperating With Plate to Press Interposed Cheese Hoops—*N. J. Peters, to Damrow Bros. Co., Fond Du Lac, Wis. No. 2,642,797. June 23, 1953.*

Food Product Forming Machine Employing Apertured Extruding Die and Rotating Means to Sever Emerging Strands—*J. E. Birdsall, Bound Brook, N. J. to C. F. Mueller Co., Jersey City. No. 2,642,819. June 23, 1953.*

Dough Conditioning Apparatus Consisting of Cabinet With Slitted Duct Walls and Exhausting System—*H. T. Hunter, Baltimore, and B. W. Wilson, Manhasset, N. Y. to Doughnut Corp. of America, New York. No. 2,642,860. June 23, 1953.*

Sanitary Valve Construction Comprising Tee and External Handle, Lock Stop, Rotary Type Plug—*E. N. Burnett, Oakland, Calif. to Gerber Products Co., Fremont, Mich. No. 2,642,894. June 23, 1953.*

Oscillating Screen Flour Sifter—*L. E. Winn, Leaksville, N. C. No. 2,642,992. June 23, 1953.*

Agitating Machine for Mixing Syrup and Water in Containers Employing Downwardly Inclined Runway With Rotating Reciprocating Carriage for Bearing Containers—*W. L. Bashford, Fresno, Calif. No. 2,643,102. June 23, 1953.*

Sausage Link Perforating Machine With Means for Adjusting to Irregularities in Shape and Size—*O. Bolton, Denver, Colo. No. 2,643,414. June 30, 1953.*

Bread Cooling and Conditioning System Including Controlled Forced Circulation of Conditioned Cooling Air—*R. H. Burgess to Drying Systems Inc., Chicago. No. 2,643,523. June 30, 1953.*

Olive Stuffer Utilizing Parallel Flat Belt Carriers, Strip Cutter, Positioning and Inserting Mechanism—*G. W. Ashlock, Jr., Oakland, Calif. No. 2,643,694. June 30, 1953.*

Smokehouse Rack Comprising Railborne Square Frame With Cross Members for Carrying Product—*C. J. Pickens, Sr., Cheviot, Ohio, to The Cincinnati Butcher's Supply Co., Cincinnati, Ohio. No. 2,643,777. June 30, 1953.*

Feed Chute for Holding Potatoes During Cutting in Chip Machine—*B. Stahmer, Omaha, Neb. No. 2,644,500. July 7, 1953.*

PACKAGING

Bag Filling Tube and Top Gripping Apparatus—*N. A. Scranton and M. A. White to A. E. Staley Mfg. Co., Decatur, Ill. No. 2,643,804. June 30, 1953.*

Pneumatic Container-Cleaning Apparatus Employing Adjustable Platform, Hood, Nozzle, Bonnet, Blowers—*J. C. Pacilio, Cicero, Ill. to White Cap Co., Chicago. No. 2,644,188. July 7, 1953.*

Device for Weighing and Packaging Potato Chips and Like Comprising Inclined Hopper With Airjet-Actuated Discharge Spout Feeding Weighing Receptacle—*F. S. Avil, Avondale Estates, Ga. No. 2,644,661. July 7, 1953.*

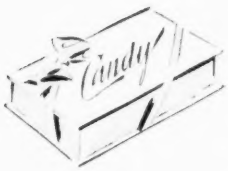
Carton for Baked Goods and Other Fragile Products Utilizing Cramming Elements in Side Edges to Retain Item in Fixed Position—*R. C. Stenger to Sutherland Paper Co., Kalamazoo, Mich. No. 2,645,337. July 14, 1953.*

Container Sterilizing System for Delivering to Sterile Filling Station Utilizing Continuous Heating and Cooling Zones With Continuously-Shifting Article-Support—*I. R. Lewis, Metuchen, N. J. and D. M. McBean, Rochester, N. Y. to Merck & Co., Inc., Rahway, N. J. No. 2,645,557. July 14, 1953.*

Method of Bulge Packing Fruits Into Rectilinear Container by Inserting Cardboard Guards, Inverting, Packing to Bulge, Affixing Bottom—*E. Meyer to United Paper Co., Tampa, Fla. No. 2,646,198. July 21, 1953.*

Package for Connected Link Sausage With Shallow Inner Separator and Top Strap Member, With Outer Wrapper Enclosure—*O. E. Seiferth, Madison, Wis. to Oscar Mayer & Co., Inc., Chicago. No. 2,646,357. July 21, 1953.*

Want more information on any of these recent patents? If so, you may obtain detailed printed copies by writing direct to the U. S. Patent Office, Washington, D. C., giving serial numbers of those you want and enclosing 25¢ for each copy.



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Men & Companies

C. L. Rumberger (left), vice-president of research and quality control, and **P. K. Shoemaker** (right), vice-president of manufacturing, are new directors of H. J. Heinz Co. Also elected to board: **J. E. Allen** and **W. B. Cormack.**

Industry

Bauer-Schweitzer Hop & Malt Co. of San Francisco has been purchased by Froedtert Corp. of Milwaukee.

Beech-Nut Packing Co. has opened regional offices in Hartford, Conn.

Bell Brand Foods, Ltd., Los Angeles, is constructing a $1,000,000 plant and office building in that city.

Blue Star Foods, Inc., canned and frozen poultry processors, will open a new processing and packing plant in Anderson, Mo.

Borden Co. is remodeling its Wellsboro, Pa., plant to increase capacity by 75%.

Carnation Co. will construct a $150,000 addition to its headquarters building in Los Angeles.

Coffee Brewing Institute, Inc., has announced retention of Dr. Samuel C. Prescott, Prof. L. H. Backer, and Arthur W. Dane as technical advisers.

Continental Can Co.'s latest acquisitions, Benjamin C. Betner Co. and Shellmar Products Corp., will operate as **Shellmar Betner Flexible Packaging Div.**

Fisher Flouring Mills Co., Seattle, has named W. L. Haley and A. J. McFarlane vice presidents.

Foremost Dairies, Inc., has merged with Marin Dairymen's Milk Co. and Dairymaid Creameries, Ltd., both of California.

Foster Frozen Foods, Inc., is constructing a $150,000 addition to its Denver plant.

Gem State Meat Packing Co., Boise, Idaho, has been purchased by Central Eureka Holding Corp., of San Francisco.

Gerber Products Co. is planning expansion of its Rochester, N. Y., plant, and has opened a new warehouse in Atlanta, Ga.

G. F. Hublein & Bro., Inc., has acquired Maltex Co., Burlington, Vt.

Golden Gift Corp., Hollywood, Calif., will begin operation of a Eustis, Fla., plant next month.

McLarens Ltd., Hamilton, Ont., will open a modern branch plant in Vancouver, B. C.

Mrs. Baird's Bakeries, Inc., has opened a new plant in Dallas.

Mutual Orange Distributors has withdrawn from citrus processing and turned its Real Gold label over to a new company, Real Gold Co.

Neuhoff Bros. Packers, Inc., has begun construction of a $100,000 addition to its Dallas plant.

Pennsylvania Salt Mfg. Co. has raised its Calvert City, Ky., development to $10,000,000.

Pepsi-Cola Co., Alexandria, Va., will increase plant facilities.

Ralston Purina Co. plans construction of a Wilson, N. C. plant.

Refined Syrups & Sugar, Inc., Yonkers, N. Y., has purchased adjoining property for plant expansion purposes.

Is your sanitation program as efficient as your production operations?

It should be, when you consider the costs going into plant clean-up—especially the labor costs.

That is one of the reasons it will pay you to investigate the benefits of a complete review of your program needs by staff specialists of the

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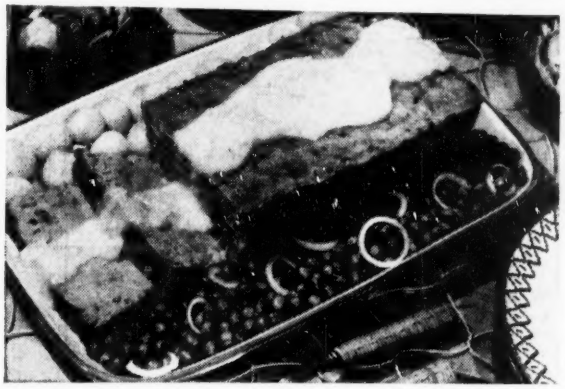
Institute of Industrial Sanitation

Home Office:
713 West Peachtree St., Atlanta, Ga.



Photograph courtesy of American Can Company

Let better taste sell for you!

• Use Huron HVP, made from wholesome nutritious wheat, to add extra flavor to your canned salmon. Give your brand greater sales appeal through stepped-up taste appeal. Huron's Technical Service will be glad to work on your particular flavor problem. Write the Huron Milling Co., 9 Park Place, New York City 7.

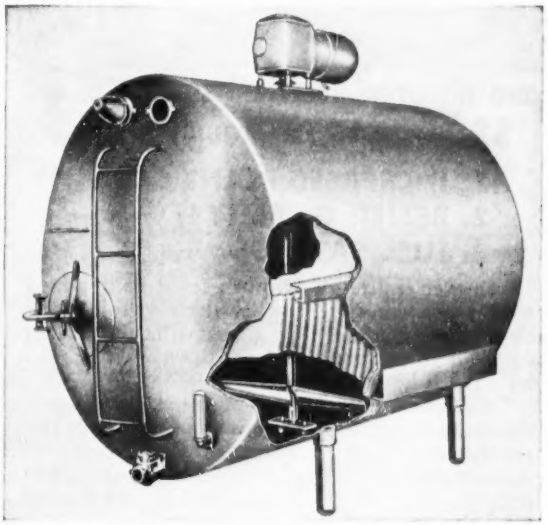
HURON HVP

HYDROLYZED VEGETABLE PROTEIN

The flavor of meat from wheat

Cool and Store in one tank

The problem of cooling and storing liquid food products in limited floor space and with a minimum of equipment cost can be solved with Mojonnier Cold-Wall Tanks, because they combine cooling and storage in one stainless steel, sanitary unit.



Mojonnier Cold-Wall Tanks have a direct-refrigerated surface built into the side walls, and are equipped with packaged controls for full-flooded operation of this surface. Ammonia, Freon, or water can be used as the cooling medium. Tanks are stainless steel, insulated, and built to the highest sanitation standards of the dairy industry. Available in vertical, horizontal, and rectangular design in capacities from 50 to 10,000 gallons. For detailed information, write for bulletins 146 and 195, to

MOJONNIER BROS. CO., 4601 W. OHIO ST., CHICAGO 44, ILL.

Mojonnier

COLD-WALL TANKS

OTHER MOJONNIER WIDELY USED FOOD PROCESSING UNITS INCLUDE: LO-TEMP EVAPORATORS • MULTIPLE EFFECT EVAPORATORS • ZONE-CONTROL VATS • VACUUM PANS • FRUIT SPREAD COOKERS • TUBULAR HEATERS • WATER CHILLERS • GERMICIDAL FRUIT SCRUBBERS • TUBULAR COOLERS • VACUUM FILLERS • BOTTLE, CASE, CAN, CARTON AND QUICK-FREEZE CONVEYORS • BEVERAGE CARBONATING UNITS; DAIRY PROCESSING EQUIPMENT

and discovered he had saved $$ THOUSANDS through:

1. INCREASED PLANT CAPACITY
2. BETTER QUALITY
3. FUEL SAVINGS

"We never realized how much could be obtained with a mere improvement in steam trapping. It's like a man with dirty eye-glasses—he thinks he's seeing perfectly until he cleans them and finds out how much he has missed.

"We installed 71 Armstrong traps (one on each steam consuming unit) at a cost of about $550. The greater heat in all units showed up in a big production increase and improved quality due to better temperature control. Of course, fuel savings resulted from the more efficient use of steam."

He's* enthusiastic about ARMSTRONG'S. Why not? He found he revitalized his whole plant. It won't hurt to check your own eye-glasses. If there's any doubt, it could pay big dividends to talk it over with your nearby Armstrong Representative.

**name on request*

HERE'S A GUIDE TO BETTER TRAPPING

SEND FOR FREE 44 PAGE STEAM TRAP BOOK

ARMSTRONG MACHINE WORKS
866 Maple Street, Three Rivers, Mich.

ARMSTRONG STEAM TRAPS

R. C. Gralow has been named director of product development of Corn Products Refining Co. He has been with the company since 1934.

Sophie Mae Candy Corp. has broken ground for a $250,000 addition to its Atlanta plant.

Texas Vegetable Oil Co. and its associate, Vegetable Oil Refining Co., both of San Antonio, have been purchased by Frito Co.

Theo Hamm Brewing Co.'s newly-acquired San Francisco brewery will be rebuilt at a cost of $5,000,000.

Tobin Packing Co., Rochester, N. Y., will double plant capacity at an estimated cost of $1,000,000.

Wagner's Frozen Foods will open a third frozen foods plant in Milwaukee.

Personnel

Howard Arnold will manage LaSalle Coca-Cola Bottling Co.'s Michigan and Wisconsin plants.

Walter Baldeschwiler has been appointed production manager of Blue Moon Foods, Inc.'s processing packaging departments at Thorp, Wis., plant.

Dr. Berton S. Clark, scientific director of American Can Co., is a newly appointed member of National Research Council's food and nutrition board.

Dorsey W. Edwards is new president of Hawaiian Fruit Packers, Ltd.

Dwight K. Grady, California Fig Institute, is chairman of newly formed Dried Fig Advisory Board, Fresno, Calif.

Jack Hohhof has been named to technical staff of Dodge & Olcott, Inc.

Arthur D. Hyde has been named to General Mills, Inc.'s executive committee.

Austin S. Iglehart is new chief executive officer of General Foods Corp.

George Jameson, former office manager, is now assistant to general manager of Sicks' Seattle Brewing & Malting Co.

John F. McKeon will manage Fairmont Foods Co.'s Boston branch.

C. P. McTague is new president of Fine Foods of Canada, Ltd.

James Allen Moore has been appointed manager of American Sugar Refining Co.'s Baltimore refinery.

Paul I. Nederman has been elected president of CVA Corp., Roma Wineries, Inc., and Cresta Blanca Wineries, Inc.

William J. R. Paton will manage Robin Hood Flour Mills Ltd.'s five Canadian mills.

J. Louis Reynolds, vice-president in charge of production of Reynolds Metals Co., is new president of Eskimo Pie Corp.

James A. Sesma is new chief chemist and production manager of Canada Dry Ginger Ale, Inc., Dallas.

Associated Industries

Chase Bag Co. has announced the appointment of James F. Porter as manager of the Toledo plant.

James B. Somerall has been elected vice-president of Pepsi-Cola Co. in its bottle sales division. He will also soon become vice-president of Pepsi-Cola Co.'s wholly-owned subsidiary, Metropolitan Bottling Co., Inc., to handle Schweppes operations throughout the United States.

Also manufacturers of Sno-Tex, Golden-Tex, Ny-Tex Neoprene, Kotton-Top Neoprene, Tred-Tex. Send for particulars.

SANI-CLEATS

Completely Sanitary for Conveying Fish, Meats, Baked Goods and Other Perishable Foods

Promotes sanitation because Sani-Cleats are vulcanized into the body of the belt. Cannot pull out and will flex around pulleys. Solves cleated belt problems and saves floor space. No bolts, rivets or metal. Replaces bucket elevators and stainless steel belts. Sani-Cleat Belt illustrated is being used for conveying chopped meat. Send operating data and let us make recommendation.

Quick delivery from our modern plant.

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This emblem appears on all Sparks Belting. Formerly Champion.

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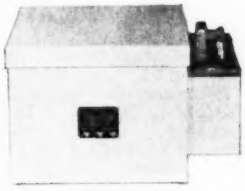
STEINLITE
LIQUID CELL
Measures Moisture
IN 1/25th THE TIME



According to FOOD TECHNOLOGY, 1951, Vol. V., No. 6

". . . the Steinlite instrument is well adapted for simple, rapid determination of moisture content of sweet corn for canning. For each determination, by the vacuum oven method, make three for Steinlite, nine for Brown-Duvel."

Compare the Time

1 Vacuum Oven Test approximately 8½ hours

9 Brown-Duvel Tests one hour each, approximately 9 hours

3 Steinlite Tests 5-6 minutes each, approximately 20 minutes

Use the Steinlite Model 300 for determining harvest time, cooking or processing time in canning or freezing corn, pumpkin, many fruits and hundreds of other food products.

WRITE FOR Descriptive Folder "A Report to Food Processors"

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EQUIPMENT CO.

734 Converse Building **Chicago 6, Illinois**

Extra Flavor Sells Canned Limas!

• Use Huron MSG, the natural wholesome taste-builder, to bring out the appetizing original flavor of your canned dried-soaked lima beans. It's boosted sales for leading canners. Huron's Technical Service may be able to help you sell more food products, too. Write to the Huron Milling Co., 9 Park Place, New York City 7.

HURON MSG

PURE MONOSODIUM GLUTAMATE 99+%

Made by the pioneers in protein derivatives

For more information, use coupon on page 207.

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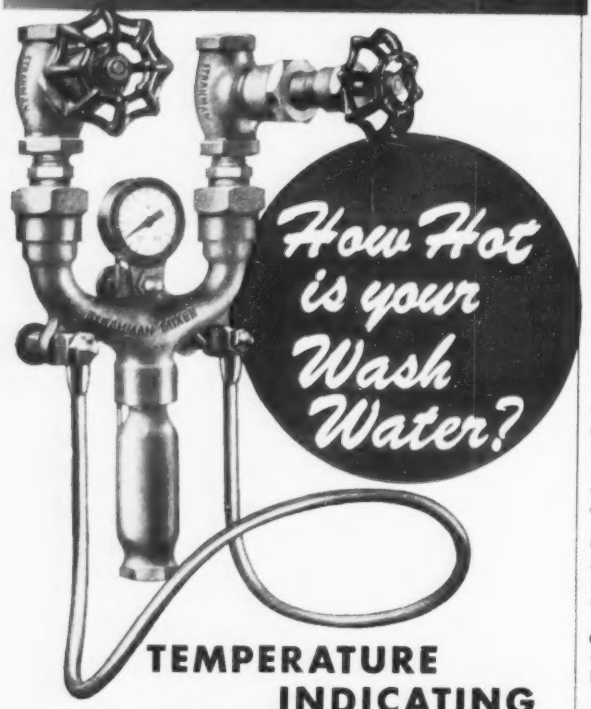
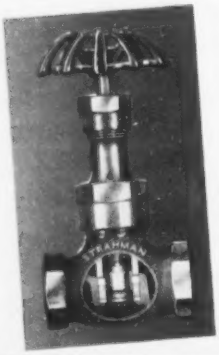


TEMPERATURE INDICATING
MIXING UNIT and HOSE STATION
For Hot and Cold Water
or Steam and Cold Water

Different clean-up operations in the Dairy and Food Processing industries require wash-up water of different but constant temperatures. Too often this is accomplished by the operator "feeling" the wash water. The Strahman Temperature-Indicating Unit eliminates this "by feel" method of judging the proper temperature.

A blending chamber at the discharge point of the unit, completely mixes the elements passed through, so that at a glance, the easily read gauge gives the operator the exact temperature of his wash water.

Strahman Temperature-Indicating Mixing Units and Hose Stations are furnished for use with steam and cold water, or hot and cold water. They may be had plain or in chrome plated finish.



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SEATLESS PISTON VALVES
Standard Equipment
on All Mixing Units

Demanded by Dairymen because:

No wire drawing or discs to crack.
No expansion or contraction problems.
Easy to operate; force is never necessary to open or close.
Economical; saves hose and eliminates costly repairs.

Consult your dealer or write direct for full information

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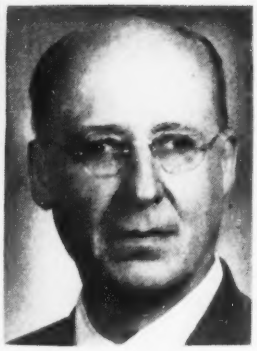

Dr. H. A. Trebler, director of engineering research and development of National Dairy Research Laboratories, Inc., has been granted early retirement and plans to devote part of his time to consulting work in the dairy engineering field.

Calco Chemical Div. of American Cyanamid has named Alden R. Loosli as manager of its market research and development dept.

Carlon Products Corp. has announced establishment of plastic pipe and fittings manufacturing facilities.

Chase Bag Co.'s Toledo plant will be managed by James F. Porter.

Cherry-Burrell Corp. has purchased the bottle washer division of Heil Co., Milwaukee.

Clark Equipment Co., Buchanan, Mich., has established a scholarship for engineering students at Ill. Inst. of Tech.

Diamond Alkali Co.'s two new vice-presidents are W. H. McConnell and C. E. Lyon.

Diversey Corp. has announced acquisition of Selcon Engineering & Chemical Co., Chippewa Falls, Wis.

Fisher Scientific Co.'s new development laboratories director is J. S. Fawcett.

Foil Kraft, Inc. has announced opening of a new Chicago plant.

General Electric Co. at Schenectady, N. Y., has appointed Dr. Louis T. Rader as general manager of specialty control.

H. P. Smith Paper Co.'s new vice-president is Jack Pendexter.

Heyden Chemical Co. has named Dr. Herman Sokol manager of its antibiotic division and Kenneth Irey as chemical production manager.

Marvel-Schebler Products Div., Borg-Warner Corp., Decatur, Ill., has appointed S. S. Meadows as vice-president.

Milprint Inc. is constructing a new South San Francisco plant.

National Can Corp. is expanding facilities at its Hamilton, O., plant to meet increased local demands.

National Sanitation Foundation has named Charles A. Farish and Jack McAllister to its new testing laboratory staff.

Package Machinery Co. has opened Philadelphia offices.

Sharples Corp.'s new executive vice-president is Fred W. Stakelbeck.

Solenoid Valve Div. of Wheaton Engineering Co., Wheaton, Ill., has been acquired by **Eclipse Fuel Engineering Co.**

Takamine Lab., Inc.'s new director is Homer C. Fritsch, formerly vice-president of Parke, Davis & Co.

Trane Laboratory's newly appointed director is Donald H. Kraus.

White Stokes Co., Inc., Chicago manufacturers of ingredients for food industry, have named C. T. Rabenau as chief chemist in charge of new product development and quality control.

Deaths

Warren J. Courtney, 80, canning industry pioneer.—August 31.

William K. Dick, 65, director of Best Foods, Inc.—Sept. 5.

Lon G. Haight, 92, co-owner of L. G. Haight & Co., Fresno, Calif., grape packers.—August 8.

A. Albert Klein, 64, leading abrasive authority, assistant director of research and development at Norton Co.—August 25.

Bernon H. McClean, 71, former plant manager of H-O Oats Co., Buffalo, N. Y.—August 29.

Edward F. McGee, 65, design engineer for Walter Baker Chocolate Div. of General Foods—August 12.

Eben T. Takamine, 63, president of Takamine Laboratory, Inc., Clifton, N. J., since 1930.—August 29.

Albert A. Teeter, 65, former vice-president and director of Chas. Pfizer & Co., Ltd.—Sept. 3.

Ross Welch, 73, founder of Welch's Candy Co., Los Angeles.—August 12.

Communist machine-gun fire dropped him in combat. But whole blood kept him alive, saw him through the hospital. He thanks you for his life.

She'd been exposed to polio. A new serum, *Gamma Globulin*, made from blood, helped ward off the dread disease. She thanks you for her life.

A tornado whipped suddenly across her home town. She was badly injured by falling debris. But a quick operation, several transfusions pulled her through. She thanks you for her life.

Three grateful people say: "We're HERE... because you were THERE!"

Each one of these people is alive today because someone gave blood.

If you've given blood before, you know how easy it is—how quick and painless. And you know what a wonderful feeling it is when you realize that what you've done may give another person his life.

Now you are asked to give blood . . . again and again. And you can do it safely every 3 months.

Because America's need for blood has increased enormously—for our armed forces, for accident and disaster victims at home, for new disease-fighting serums.

Many a life hangs in the balance! Will you help? Call your Red Cross, Armed Forces or Community Blood Donor Center today!

BUSINESS EXECUTIVES CHECK THESE QUESTIONS

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ◯ HAVE YOU GIVEN YOUR EMPLOYEES TIME OFF TO MAKE BLOOD DONATIONS?
- ◯ HAS YOUR MANAGEMENT ENDORSED THE LOCAL BLOOD DONOR PROGRAM?
- ◯ HAS YOUR COMPANY GIVEN ANY RECOGNITION TO DONORS?
- ◯ HAVE YOU INFORMED EMPLOYEES OF YOUR COMPANY'S PLAN OF CO-OPERATION?
- ◯ DO YOU HAVE A BLOOD DONOR HONOR ROLL IN YOUR COMPANY?
- ◯ WAS THIS INFORMATION GIVEN THROUGH PLANT BULLETIN OR HOUSE MAGAZINE?
- ◯ HAVE YOU ARRANGED TO HAVE A BLOODMOBILE MAKE REGULAR VISITS?
- ◯ HAVE YOU CONDUCTED A DONOR PLEDGE CAMPAIGN IN YOUR COMPANY?
- ◯ HAVE YOU SET UP A LIST OF VOLUNTEERS SO THAT EFFICIENT PLANS CAN BE MADE FOR SCHEDULING DONORS?

Remember, as long as a **single** pint of blood may mean the difference between life and death for **any** American . . the need for blood is **urgent!**

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...give it again and again

Just Off the Press

New Catalogs and Bulletins from manufacturers of equipment and supplies — Free For The Asking —

Food Plant Equipment

Coolant Filters

Leaflet describes operation of gravity filters in various types of grinders. 4 pages.—*Industrial Filtration Co., Lebanon, Ind.*

Circle 278A on Reader Service Card

Circulation Heaters

Typical applications and operating characteristics of electric circulation heaters are given in Bulletin 701.—*Edwin L. Wiegand Co., 7701 Thomas Blvd., Pittsburgh 8.*

Circle 278B on Reader Service Card

Materials Dryer

Bulletin D4B3 describes features of materials dryer with details on complete installation, and drying data.—*Denver Equipment Co., 1400 17th St., Denver 17.*

Circle 278C on Reader Service Card

Can Ejector

Robot can ejector is presented in leaflet with photos and details on operation.—*Illumi Tronic Engineering Co., 680 East Taylor Ave., Sunnyvale, Calif.*

Circle 278D on Reader Service Card

Steel Utensils

Complete line of stainless steel and monel utensils is described in illustrated catalog. 4 pages.—*Metalsmiths, Division of Orange Roller Bearing Co., Inc., 560 White St., Orange, N. J.*

Circle 278E on Reader Service Card

Valve-Actuators

Bulletin 3000 illustrates and describes new line of valve actuators designed as package units, and gives instructions and tables for use.—*Ledeen Mfg. Co., 1600 S. San Pedro St., Los Angeles 15.*

Circle 278F on Reader Service Card

Steel Tanks

Custom-built stainless steel storage tanks are presented in brochure with details on helpful accessories and tables of usual tank dimensions. 4 pages.—*Cherry-Burrell Corp., 427 W. Randolph St., Chicago 6.*

Circle 278G on Reader Service Card

Piston Fillers

Bulletin 103 deals with four types of piston fillers for packaging and bottling semi-solid materials. 4 pages.—*F. L. Burt Co., 571-7th St., San Francisco 3.*

Circle 278H on Reader Service Card

Feeder Systems

Condensed presentation of complete line of feeders, mixers, sifters, weighers and packers is given in Catalog 801. 36 pages.—*B. F. Gump Co., 1325 S. Cicero Ave., Chicago 50.*

Circle 278I on Reader Service Card

DC Motors

Fully illustrated Bulletin 1450 deals with DC motor and generator construction and application. 16 pages.—*Louis Allis Co., Milwaukee 7.*

Circle 278J on Reader Service Card

Winches and Car Pullers

Hand and motor winches and car pullers are treated in illustrated Bulletins 753 and 853. 4 and 8 pages. — *Stephens-Adamson Mfg. Co., Aurora, Ill.*

Circle 278K on Reader Service Card

Infra-Red Oven

Photos and dimensions of infrared oven are feature of leaflet.—*Miskella Infra-Red Co., E. 73rd & Grand Ave., Cleveland 4.*

Circle 278L on Reader Service Card

Pressure Gages

Catalog 7001 lists and illustrates line of pressure and vacuum gages for indicating, controlling and recording. 32 pages.—*Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne & Windrim Aves., Philadelphia 44.*

Circle 278M on Reader Service Card

Roller Chain Wheels

Book 2449 covers roller chain wheels with taper bushings. 16 pages.—*Link Belt Co., 307 N. Michigan Ave., Chicago 1.*

Circle 278N on Reader Service Card

Universal Balance

Manual explains new model universal balance. 4 pages.—*Voland & Sons, Inc., New Rochelle, N. Y.*

Circle 278O on Reader Service Card

Pumping Units

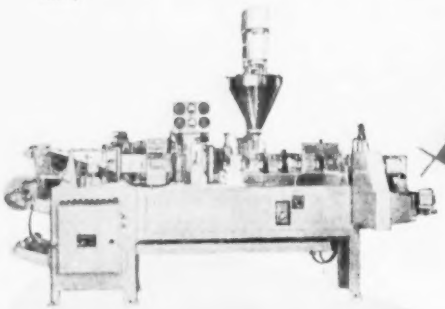
Units for pumping, heating, straining of fuel oils are described and illustrated in Bulletin 16-H. 8 pages.—*Schutte & Koerting Co., Cornwells Heights, Bucks County, Pa.*

Circle 278P on Reader Service Card

Packaging Problems?

BARTELT CAN HELP!

Colorful, individual packages which effectively display your product can be made automatically and economically on Bartelt Packaging Machines. Bartelt Packages *make the bag* from a roll of paper, film, or foil; *fill* by count, volume, or special feeder; and *heat seal* accurately and safely. If you can use a pouch style, heat-sealed package, our machines may be adaptable to your needs. Send us your packaging problem today.



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The rugged structure of every YALE Electric Truck is designed to house the most efficient power plant available... to insure more than ample capacity for your particular lifting, moving and stacking jobs. The trouble-free YALE hydraulic system provides sure, steady power for safer, smoother lifting and lowering. Yet, with all these advantages... with power and stamina to spare... YALE Electric Trucks are economical to own, operate and maintain... amazingly versatile for every materials handling problem.

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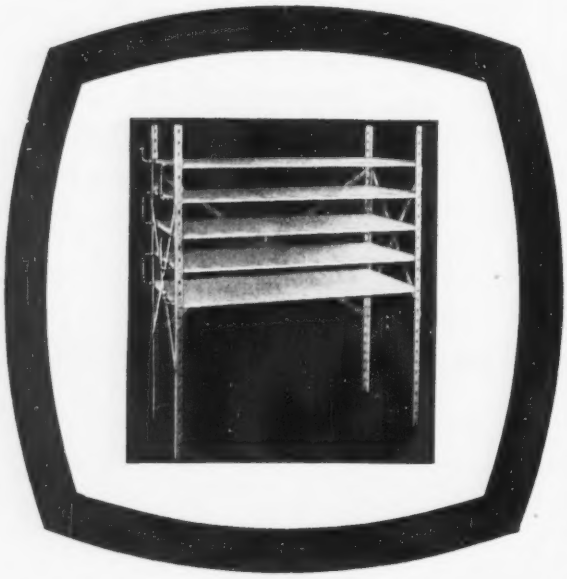
Where the best in refrigeration is required . . . specify . . . DOLE QUICK FREEZE PLATES



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By conduction, the intensely cold DOLE **QUICK FREEZE PLATES** freeze meats 1½ to 5 hours faster than by the ordinary convection, pipe-coil method. As a result there is less shrinkage, with greater operator comfort in the freeze areas. DOLE **QUICK FREEZE PLATES** are available in various sizes, ready to be set up in the freeze room or cabinet . . .

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44 Elgin Street, Brantford, Ontario

Maximum Refrigeration Efficiency
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MANUFACTURERS OF
THE COIL LINE

Centrifugal Pumps

Standard end-suction centrifugal pumps are subject of Bulletin W-300-B4. 4 pages.—*Worthington Corp., Centrifugal Pump Div., Harrison, N. J.*

Circle 280A on Reader Service Card

Liquid Processing

Line of liquid processing equipment from filters and mixers to pumps and tanks is treated in catalog. 32 pages.—*Alsop Engineering Corp., Milldale, Conn.*

Circle 280B on Reader Service Card

Rubber Bearings

Catalog deals with use of rubber bearings in industrial equipment, including engineering details. 32 pages.—*Lucian Q. Moffitt, Inc., 533 South Main St., Akron, O.*

Circle 280C on Reader Service Card

Oil-Free Compressors

Various types of oil-free compressors are presented in two brochures with illustrations and charts. 4 and 8 pages.—*Joy Mfg. Co., Henry W. Oliver Bldg., Pittsburgh 22.*

Circle 280D on Reader Service Card

Centrifugal Blowers

Information on centrifugal blowers and exhausters for air or gas handling, with illustrations of typical applications and performance, are given in Bulletin B-6. 32 pages.—*Lamson Corp., Syracuse, N. Y.*

Circle 280E on Reader Service Card

Portable Space Heaters

Guide to the selection and use of portable space heaters presents factors to be considered in safe heating and comparative advantages of various heaters now used. 37 pages.—*Herman Nelson Div., American Air Filter Co., Inc., Moline, Ill.*

Circle 280F on Reader Service Card

Motor Starters

Magnetic starters with vertical overloads are dealt with in illustrated brochure.—*Arrow-Hart & Hegeman Electric Co., Hartford 6, Conn.*

Circle 280G on Reader Service Card

Furnace Units

Furnace units for use in candy cooking are described in leaflet.—*Eclipse Fuel Engineering Co., Rockford, Ill.*

Circle 280H on Reader Service Card

Voltage Drives

Booklet presents complete information on adjustable voltage drive for variable speed applications. 16 pages.—*Westinghouse Electric Corp., Box 2099, Pittsburgh 30.*

Circle 280I on Reader Service Card

Cooling Fans

Pamphlet features types of fans available for varied requirements from cooling towers to giant air-conditioning systems. 4 pages.—*Koppers Co., Inc., 280 Scott St., Baltimore 3.*

Circle 280J on Reader Service Card

Control Equipment

Annunciator Systems

Brochure deals with self-policing annunciator systems with photos, diagrams, and description of uses. 6 pages.—*Scam Instrument Corp., 3909 W. Irving Park, Chicago 18.*

Circle 280K on Reader Service Card

Electrical Scales

Six new models of electrical and mechanical scales are presented in illustrated pamphlet with detailed specifications. 4 pages.—*Exact Weight Scale Co., Columbus 8, O.*

Circle 280L on Reader Service Card

Gravity Measurement

Catalog 14-A-12 gives detailed description of gas specific gravity measurement and control systems with several possible applications. 4 pages.—*Permutit Co., 330 W. 42nd St., New York 36.*

Circle 280M on Reader Service Card

Pneumatic Control

Catalogs 8305 and 8950 present information on non-indicating electric, electronic and pneumatic controllers, as well as control accessories, with specifications, drawings, and application data included. — *Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44.*

Circle 280N on Reader Service Card

Industrial Thermometers

Both mercury-in-glass and bimetallic thermometers are featured in catalog. 16 pages.—*Precision Thermometer & Instrument Co., 1434 Brandywine St., Philadelphia 30.*

Circle 280O on Reader Service Card

Manually-Operated Indicators

Catalog ND42 contains comprehensive information on manually-operated portable and panel indicators for measuring temperature, electrolytic conductivity or pH. 24 pages.—*Leeds & Northrup Co., 4907 Stenton Ave., Philadelphia 44.*

Circle 280P on Reader Service Card

Industrial Balances

Folder contains description of new micrometer poise models designed for use without loose weights and for rapid traverse.—*Burrell Corp., 2223 Fifth Ave., Pittsburgh 19.*

Circle 280Q on Reader Service Card

Speed Changers

Pamphlet describes miniature combination variable and fixed ratio speed changers with diagrams.—*Metron Instrument Co., 432 Lincoln St., Denver 9.*

Circle 280R on Reader Service Card

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BALTIMORE PLANT • [illegible] Maryland. Also a long-established company [illegible] serves the Baltimore-Washington area, the Baltimore [illegible] sells a full line of corrugated paperboard products. It was, until the merger, known as "The Maryland Container Company."

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Head Office: San Francisco 11, California

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153

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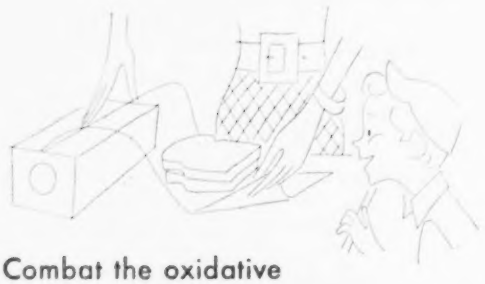

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Electronic Recorder

Information sheet describes various combinations of control and alarm available with recorder and reference data on setting, ratings, and control variations.—*The Foxboro Co., Foxboro, Mass.*

Circle 282A on Reader Service Card

Speed Measurement

Bulletin 31-P8 deals with measurement of speed by resonance or vibration. 16 pages.—*James G. Biddle Co., 1316 Arch St., Philadelphia 7.*

Circle 282B on Reader Service Card

Refrigeration Control

Bulletin 109 deals with the application of mercury-bulb instrumentation in refrigeration control. 4 pages.—*Partlow Corp., New Hartford, N. Y.*

Circle 282C on Reader Service Card

Filter Unit

Construction features, technical data and dimensions are covered in bulletin featuring unit to filter and dehydrate compressed air.—*Hankinson Corp., 951 Banksville Rd., Pittsburgh.*

Circle 282D on Reader Service Card

Materials Handling

Cable Conveyors

Folder explains function and advantages of cable conveyor systems for materials handling. 6 pages.—*Cable-Link Corp., 20175 John R Street, Detroit 3.*

Circle 282E on Reader Service Card

Electric Trucks

Bulletins 209, 703, 718N, and 732Z present models and special features of complete line of electric industrial trucks and hydraulic elevating equipment with installation photographs, specifications, and dimensions.—*Raymond Corp., 62107 Madison St., Greene, N. Y.*

Circle 282F on Reader Service Card

Conveyor Belts

Various types of woven wire conveyor belts are pictured and described in Bulletin 107. 4 pages.—*Cambridge Wire Cloth Co., Cambridge, Md.*

Circle 282G on Reader Service Card

Polyethylene Carboy

Illustrated brochure describes features, specifications and advantages of unbreakable polyethylene carboy. 8 pages.—*Plax Corp., West Hartford, Conn.*

Circle 282H on Reader Service Card

Fork-Lift Trucks

Four pamphlets list types of fork-lift trucks, parts, and accessories with detailed suggestions for use in specific situations.—*Towmotor Corp., 1226 E. 152nd St., Cleveland 10, O.*

Circle 282I on Reader Service Card

Air Conveyor

Description with photos and diagrams of system which blows flour through sealed pipes is offered in Bulletin AF-100. 16 pages.—*Fuller Co., Catasauqua, Pa.*

Circle 282J on Reader Service Card

Collapsible Container

Brochure deals with characteristics and uses of collapsible cord fabric and synthetic rubber container. 8 pages.—*United States Rubber Co., 10 Eagle St., Providence, R. I.*

Circle 282K on Reader Service Card

Gravity Conveyor

Bulletin provides detailed information on aluminum gravity conveyor system with instructions on installation.—*Speedways Conveyors, Inc., 143 Speedways Bldg., 202-208 Rhode Island St., Buffalo 13, N. Y.*

Circle 282L on Reader Service Card

Plant Supplies

Plastic Coating

Folder presents special corrosionproof plastic coating to be brushed, dipped, or sprayed.—*Stonhard Co., 1306 Spring Garden St., Philadelphia 23.*

Circle 282M on Reader Service Card

Centralized Lubrication

Panoramic presentation of centralized lubrication system is offered in Bulletin 26. 20 pages.—*Farval Corp., 3295 E. 80th St., Cleveland 4.*

Circle 282N on Reader Service Card

Rubber Linings

Special cementing procedures for bonding sheet rubber to steel are explained in bulletin. 8 pages.—*Metalweld, Inc., Scotts Lane & Abbotford Ave., Philadelphia.*

Circle 282O on Reader Service Card

Electrical Wiring

Illustrated catalog contains detailed diagrams of electrical wiring devices.—*Rodale Mfg. Co., Inc., Emmaus, Pa.*

Circle 282P on Reader Service Card

Hard Facing

Brochure explains method of lowering maintenance and replacement costs through hard facing of wearing surfaces. 4 pages.—*Cleveland Hard Facing Inc., 3047 Stillson Ave., Cleveland 5.*

Circle 282Q on Reader Service Card

Quick Couplers

Quickly connected and disconnected couplers handling air, water, steam, oil and most chemicals are dealt with in leaflet. 4 pages.—*Snap-Tite, Inc., 210 Titusville Road, Union City, Pa.*

Circle 282R on Reader Service Card

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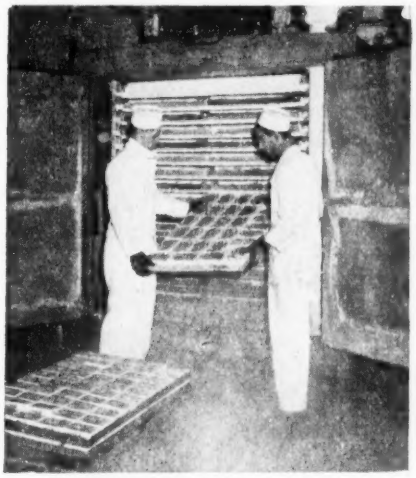

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Designed For Ammonia, Brine or Freon Refrigerant

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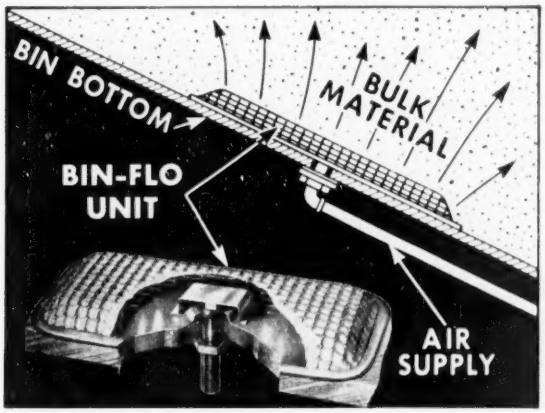

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Corrosion Resistance

Corrosion Resistance of Copper and Copper Alloys explains chemical and physical nature of corrosive attack in its various forms, including table of relative resistances. 28 pages.—*American Brass Co., Waterbury 20, Conn.*

Circle 284A on Reader Service Card

Silicone Rubber

Applications of silicone rubber parts in industry are covered in bulletin. — *Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown 1, O.*

Circle 284B on Reader Service Card

Sanitation Products

Folder gives description and pictures of various types of sanitation products for rest room maintenance. 4 pages.—*Brulin & Co., Inc., 2939 Columbia Ave., Indianapolis 7, Ind.*

Circle 284C on Reader Service Card

Structural Member

Complete engineering details of new structural steel framing member are provided in catalog. 4 pages.—*Versabar Div., M-H Standard Co., 517-521 Communipaw Ave., Jersey City 4.*

Circle 284D on Reader Service Card

Self-Locking Nuts

One-piece, all metal self-locking nuts are discussed in leaflet. 4 pages. — *Standard Pressed Steel Co., Jenkintown, Pa.*

Circle 284E on Reader Service Card

Rodent Killers

Colorful brochure describes new and improved rodenticide of anti-coagulant type.—*Motomco, Inc., 10 Murray St., New York 7.*

Circle 284F on Reader Service Card

Brass Fittings

Brochure discusses use of brass fittings with plastic pipe. 4 pages. —*Nelson Foundry Co., 6116 Oakton St., Morton Grove, Ill.*

Circle 284G on Reader Service Card

Flame-Cutting Guides

Bulletin 101 features line of flame-cutting guides. 4 pages.—*New Era Mfg. Co., 458 W. 29th St., Chicago 16.*

Circle 284H on Reader Service Card

Wire Stitching

Bulletin AD-130 illustrates new arcuate wire stitching method. 4 pages.—*Acme Steel Co., 2840 Archer Ave., Chicago 8.*

Circle 284I on Reader Service Card

Miscellaneous

Aldehydes Application

Comprehensive booklet serves as a handy reference for applications of aldehydes, their physical properties, shipping data, specifications, and test methods. 36 pages.—*Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17.*

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Anti-Heat Equipment

Salt tablets, dispensers, and respirators are among anti-heat equipment listed in booklet. 4 pages.—*Pulmosan Safety Equipment Corp., 644 Pacific St., Brooklyn 17.*

Circle 284K on Reader Service Card

Odor Control

Brochure contains data on problem of industrial odor control. 6 pages.—*Airkem Industrial Distributors, Inc., 241 E. 44th St., New York 17.*

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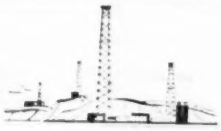
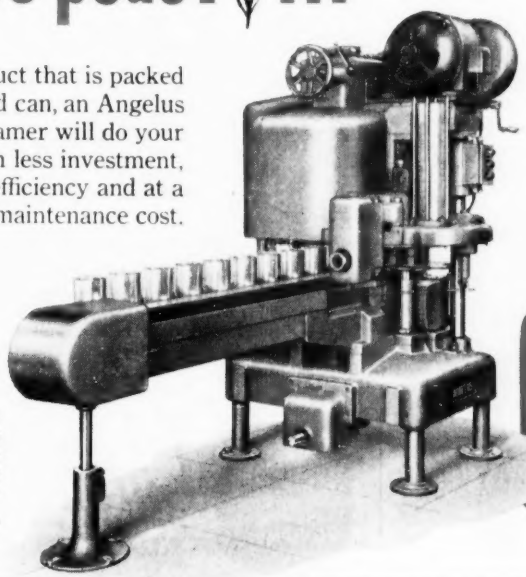


For any product that is packed in a round can, an Angelus Automatic Seamer will do your job with less investment, maximum efficiency and at a lower maintenance cost.



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High speed, straight line feed seamer for spill-free closing of round cans 2" to 4¼" in diameter—up to 400 cans per minute

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Then Use This Distinguished Line of Close-Coupled Pumps

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FLAVOR NEWS

AN AMAZINGLY EFFECTIVE REPLACEMENT FOR COUMARIN TO MEET THE NEEDS OF THE TIMES

From the research laboratories of Florasynth Laboratories, Inc. comes a new ingredient...PROTOVANOL "C" . . . a more than satisfactory replacement for the discontinued Coumarin. With the restriction by the Federal Food and Drug Department, the requirement for a practical yet economical replacement has indeed been a source of considerable concern to many extract firms and manufacturers. To this extent Florasynth has created PROTOVANOL "C", which in the opinion of the trade, has already proved by practical test and comparison—the flexibility and utility vital to the quality and success of food products . . .

For your test purposes we are making available PROTOVANOL "C" at the volume price of $5 a lb.

PROTOVANOL C

Ounce for ounce, PROTOVANOL "C" is the approximate equivalent of Coumarin in strength . . . is fully soluble in alcohol, propylene, and to an extent even in vegetable oils . . .

It has amazing versatility . . . readily mixed in various dry bases . . . and readily absorbed in cane sugar, corn sugar or starch . . .

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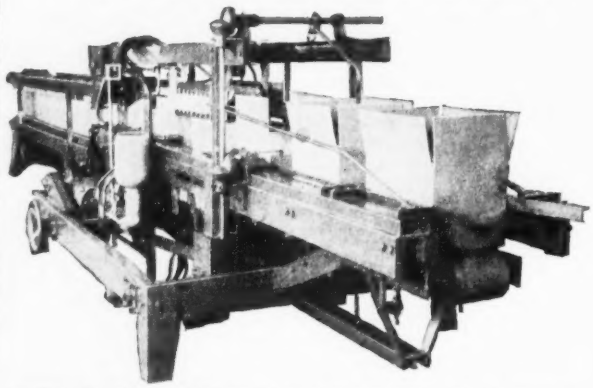

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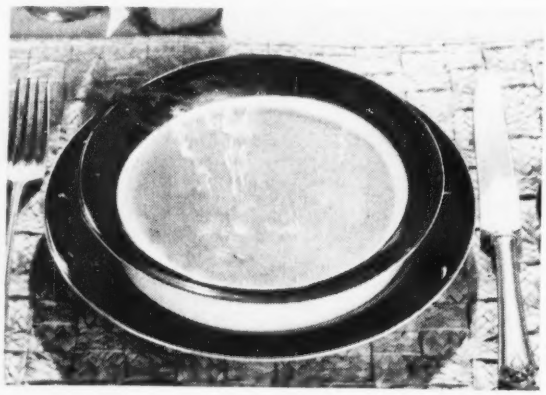


Puts more richness in soup!

● Give your brand of canned soup a head start with Huron MSG. Wholesome, natural MSG is already boosting flavor—and sales—for fully half the canned soups on the market. Take a tip from the leaders. Write Huron's Technical Service Department for help on your particular flavor problems. The Huron Milling Co., 9 Park Place, New York City 7.

HURON MSG

PURE MONOSODIUM GLUTAMATE 99+%

Made by the pioneers in protein derivatives

Moisture Removal

—Continued from page 147

Heat is supplied to each evaporator, from the vapor header common to all, by means of separate steam-booster-recompression systems. In addition to a recompression booster for each evaporator, a fourth is employed to recompress juice vapor for final condensing.

Juice is circulated from each evaporator through the next and also in part recirculated. Temperature is maintained at approximately 70 deg. F. throughout the entire evaporation cycle.

Moisture Removed by Heat-Pump

In areas that are favored by low-to-moderate power rates and where water supply is limited, not only have heat-pump evaporating systems turned out uniform, high quality concentrates, but they have produced them economically.

Systems fall into two general classifications, those applying the heat pump by direct means to evaporate juice and condense vapors, and those employing an indirect application for heating and cooling.

These heat pump systems, as well as the all steam systems, require constant air ejection. In some cases mechanical vacuum pumps could be applied for air evacuation. However up to the present, the steam air ejector method is employed on all juice concentrating installations.

In one such system, hot ammonia gas from refrigeration compressors provides the heat of evaporation in units which serve the dual function of evaporating juice and condensing refrigerant vapors. Employed is a single effect system in three stages. Juice from the first evaporator is pumped to the second evaporator and then to the third.

Juice vapor is condensed in another dual-function unit. Here, liquid refrigerant is evaporated to condense juice vapors. Another direct heat-pump application differs primarily in the use of multiple effects and special refinements, such as use of condensate, etc.

Indirect Heat Pump Method

One general departure from the direct heat-pump method characterizes the indirect system. Heat supplied to one of the triple effect evaporators is by water, warmed to approximately 90 deg. F. in a heat exchanger where Freon from the refrigeration compressors is condensed.

Final removal of juice vapors is accomplished by use of refrigerated water (37 deg. F.) in the barometric condenser.

Whys of Economies

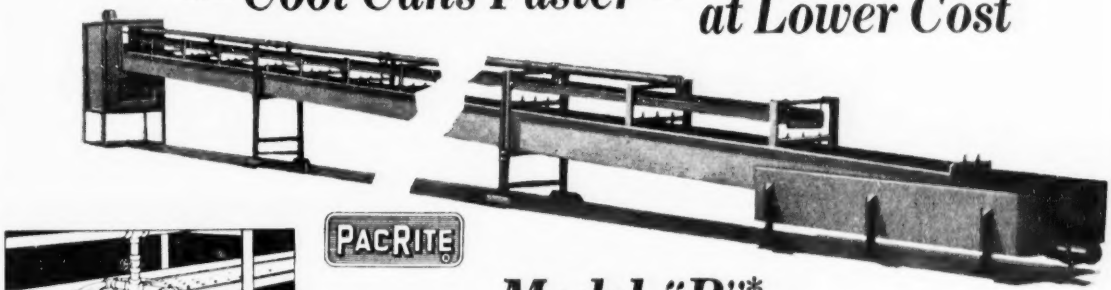
Whether the source of heat is a steam boiler or a refrigeration compressor, evaporation in any system is proportional to the heat supplied. Therefore, the cost of heat in terms of power or fuel is the major element in the operating cost of concentrating.

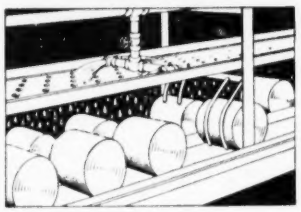
Both multiple effects and multiple stages conserve available heat. Vapor recompression and thermal recompression are necessary for economical evaporation at low temperatures.

In the all steam systems, steam recompression raises vapor temperature above that of condensing water. Through thermal recompression in the heat-pump systems, condenser water temperature is lowered below that of the vapors to be condensed.

Two other systems merit attention as a means of solving

Cool Cans Faster — at Lower Cost





Model "R"*
SPINNER COOLER

Costly chain and can conveying rods are eliminated on the PacRite Model "R" Spinner Cooler. Greater agitation of cans is provided through a start-stop-back-and-go action. The use of "stop-rods" prevents the cans from rolling back down the belt but permits them to advance freely. Can guides are adjustable for nearly any size can. The Model "R" Spinner Cooler is manufactured in two and four lane models and in lengths for any volume.

TELL US —
- The product to be cooled
- Size of the cans
- Number of cans per minute

We will recommend the proper cooler

* Patent applied for

25 Years of Service 1928 1953

AMERICAN MACHINERY CORPORATION
ORLANDO, FLORIDA

For more information, use coupon on page 207.

specific low temperature evaporating problems. Both are currently in use in Europe. Details of these two systems follow.

Controlled Film Type

A continuous, single pass, agitated falling film evaporating system, of Swiss origin, is especially adapted to handle liquids that are very viscous or that foam excessively. Evaporator section consists of a single jacketed shell in which blades on a central shaft are whirled at controlled speed.

Rotor blade velocity throws liquid against milled inner surface of jacketed cylinder where liquid is forced by blade action to spiral down heating surface. Clearance between blades and cylinder surface is as little as $\frac{1}{32}$ in., time of contact with the heating surface 5 to 7 sec.

This extremely short time exposure to the heating surface is claimed to permit evaporation at temperatures well above those normally employed. Evaporating system has been successfully applied in the processing of caramel candy, fruit juices, gelatin, coffee concentrating, vitamins, and antibiotics.

System Requiring Only Electricity

Also in use on the Continent is an evaporating system that requires no water, steam, or refrigeration except the small amount required for jet ejection. Suction side of a motor driven turbo-blower serving as a thermo-compressor creates the vacuum in the evaporators. Pressure side of turbo delivers heated vapors to the outside of evaporator tubes where vapors are condensed, thus providing heat of evaporation.

Reported to be very economical to operate, this type evaporating system may prove important in this country in areas where water is scarce and where the cost of electricity is low to moderate.

Since it costs less to evaporate water than to ship it, and also since container costs can be reduced by as much as 50%, it is reasonable to expect drying and concentrating techniques of the food industry to make rapid strides in the next 10-20 years.

End (Resume reading on page 149)

Quality Control

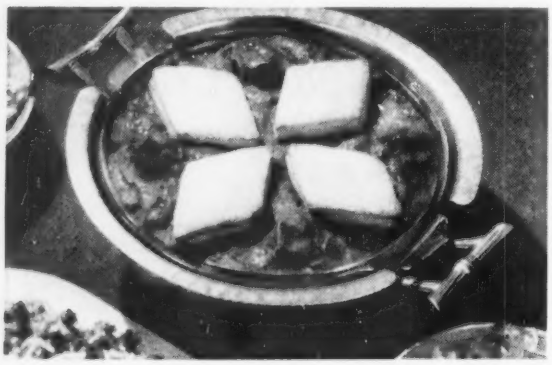
—*Continued from page 90*

Recently, this instrument has been applied by a West Coast brewery in delicate color blending of beers, being more precise than the visual methods of skilled blenders. Spectrophotometers actually have proved more accurate than panels in the determination of off-flavors in milk, fats, and oils.

Fast Coming Techniques

In addition to these gains in objective testing are some fast-coming new techniques. Most intriguing is the field of nuclear instrumentation, which utilizes tiny, subnuclear particles as measuring "probes".

A new method of photographic reproduction—exerography—has been developed which may greatly speed and simplify X-ray inspection. This works on the ability of selenium to conduct X-rays. The sample is laid on a selenium plate, exposed, and the image is thus "electrically" distributed according to penetration intensity of



Gets real beef flavor

• For your canned beef stew, take a tip from the leaders. Many famous brands of beef stew are made with Huron MSG to give them a rich, "real beef" flavor. Boost your sales too with this same wholesome natural product. Our Technical Service Department will be glad to help you solve your particular flavor problems. Write today. The Huron Milling Co., 9 Park Place, New York City 7.

HURON MSG

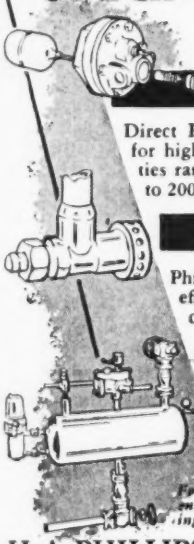
PURE MONOSODIUM GLUTAMATE 99+%

Made by the pioneers in protein derivatives

"A Simple CONTROL IS THE Best CONTROL"

. . . for efficiency's sake . . .

SPECIFY PHILLIPS FLOAT CONTROLS



FLOAT CONTROLS

Direct Feed and Remote Feed types adaptable for high side or low side applications. Capacities range from 1 to 1000 tons for "Freon"; 1 to 2000 tons for ammonia.

REFRIGERANT INJECTOR

Phillips refrigerant injection provides high efficiency evaporation with "Freon", especially in high capacity, flooded operation.

LIQUID RETURN SYSTEM

The Phillips system protects ammonia compressors against liquid slop-over and gives dry suction line gas for top compressor efficiency.

For dependable, efficient operation of your present or new equipment, choose Phillips—engineering advice willingly given. Write for catalog.

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BUSINESS EXECUTIVES
CHECK THESE QUESTIONS

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ◯ HAVE YOU GIVEN YOUR EMPLOYEES TIME OFF TO MAKE BLOOD DONATIONS?
- ◯ HAS YOUR MANAGEMENT ENDORSED THE LOCAL BLOOD DONOR PROGRAM?
- ◯ HAS YOUR COMPANY GIVEN ANY RECOGNITION TO DONORS?
- ◯ HAVE YOU INFORMED EMPLOYEES OF YOUR COMPANY'S PLAN OF CO-OPERATION?
- ◯ DO YOU HAVE A BLOOD DONOR HONOR ROLL IN YOUR COMPANY?
- ◯ WAS THIS INFORMATION GIVEN THROUGH PLANT BULLETIN OR HOUSE MAGAZINE?
- ◯ HAVE YOU ARRANGED TO HAVE A BLOODMOBILE MAKE REGULAR VISITS?
- ◯ HAVE YOU CONDUCTED A DONOR PLEDGE CAMPAIGN IN YOUR COMPANY?
- ◯ HAVE YOU SET UP A LIST OF VOLUNTEERS SO THAT EFFICIENT PLANS CAN BE MADE FOR SCHEDULING DONORS?

Remember, as long as a **single** pint of blood may mean the difference between life and death for **any** American . . the need for blood is **urgent!**

NATIONAL BLOOD PROGRAM

this man has ice water in his veins!

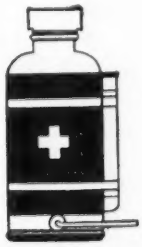
Of course he'd never volunteer to give blood, anyway. But any resemblance of this old duffer to the average, red-blooded American is a mistake.

For instance, several million healthy Americans have given blood. *But it's not enough.*

So this is to tell several million more Americans that their blood is needed—now!

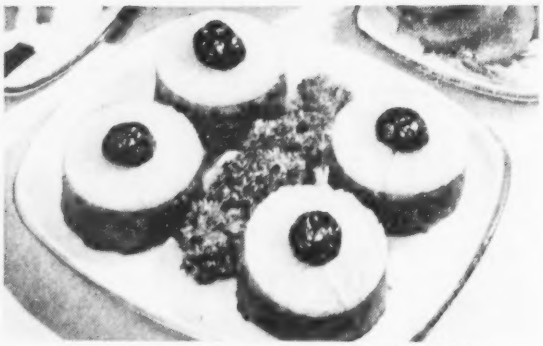
We've never let anyone down who was in trouble. When a GI gets wounded and suffers *shock*—he's in bad trouble. He's got to have blood and lots of it! Folks here at home need blood too—to save their lives.

So make a date with your Red Cross, Armed Forces or Community Blood Donor Center. *One* hour and you're on your way.



GIVE BLOOD

...give it again and again



Photograph courtesy of American Can Company

Here's proof of improved flavor

• Consumer preference tests at Michigan State College showed a whopping 84½% preference for canned corned beef hash made with hydrolyzed vegetable protein. Think what adding Huron HVP can mean to *your* sales! It's made only from wholesome, nutritious wheat. Huron's Technical Service Department likes to work on flavor problems. Write today. The Huron Milling Co., 9 Park Place, New York City 7.

HURON HVP

HYDROLYZED VEGETABLE PROTEINS

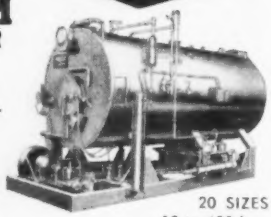
The flavor of meat from wheat

1. SET IT ON YOUR CONCRETE FLOOR
2. MAKE SERVICE CONNECTIONS
3. TURN ON THE STEAM!

You Never Saw a UNIT So Easy to INSTALL and OPERATE!

AMESTEAM GENERATOR

- is fully piped and wired.
- needs no special foundation.
- is factory insulated and jacketed.
- has its own refractories.
- needs no heavy, costly stack.



20 SIZES
10 to 600 h.p.
15 to 200# OIL OR GAS

WRITE FOR FREE BULLETIN TODAY!

AMES IRON WORKS BOX C-103 OSWEGO, N. Y.

AMES IRON WORKS
Box C-103 OSWEGO, N. Y.
Gentlemen:
Please send me further information on AMESTEAM GENERATORS and name of the nearest representative.
NAME.....
COMPANY.....
ADDRESS.....

X-rays. Then a powdered pigment is held electrostatically on the plate and a master copy run off.

Another of the many possibilities for X-rays is in continuous-density analysis. At least two such units have been developed with food in mind. And these eventually may control processes automatically.

One system employs an ionization chamber to absorb X-ray beam projection through the product, and is claimed sensitive to 1% change in sugar-solution density. An application under study is grading pineapple slices on basis of solids content.

The other absorption unit employs barium sulfate as its sensitive pick-up, but could use an ionization chamber, geiger counter, or fluorescent screen.

I. R. Sharpens Research

Ionizing radiation is a highly promising research tool. Many elements, after bombardment, spontaneously disintegrate, and these can be identified by mass spectrometry. Technique, which is extremely sensitive, provides an accuracy of 10% or better in determining obscure trace elements. Recent tests came up with heretofore unknown pesticidal residues in milk, butterfat, and meat. Even strontium was pinpointed, at less than .01 ppm. in a milk product.

The beta-ray gage provides unbelievable precision in measuring density and thickness of materials. And gamma ray devices are broadening product inspection techniques.

Concurrent with faster and more precise analytical measurement has come a means of putting this information to work—statistical quality control. Many hold that advanced laboratory instrumentation makes no sense unless coupled with this technique. Even speedy tests have to be based on scientific sampling procedures.

Augmenting lab instrumentation, and fitting nicely into the SQC pattern, are newly developed electronic counting devices that speed and collate test information.

In-Stream Tomorrow

Despite the many new analytical instruments, the control lab of 1978 will be less encumbered.

Analytical instruments are moving to the production line. Continuous processes can't wait for tests at a remote lab bench. Qualities have to be measured quickly and, if possible, continuously.

Developments in objective instruments to dynamically measure food qualities such as color, density, texture, blend—yes, even odor and taste—are the prime movers in this trend. And already many measurements are made in-stream, permitting automatic control.

Continuous in-stream quality control will eliminate statistical sampling. But complex evaluation—now done by statistics—still will be necessary. This problem will be solved by electronic computers.

Hence, the 1978 quality-control technologist will be a process engineer. He will sit at a panel and interpret, perhaps slightly adjust, the balance in an automatic program of quality control.

How to Prepare

How should a food processor plan for the future?

Primary need is a food engineer. Next is proper equipment and facilities. Investment in expensive devices may seen prohibitive. But precise and versatile analytical instruments sometimes pay off in a few months.

Finally, the need for scale values to judge product qualities cannot be overemphasized. Preconceived ideas that a quality is unmeasureable will be set aside by progress.

End (Resume reading on page 90)

PROFESSIONAL SERVICES

PROCESSING PROBLEMS — PRODUCT DEVELOPMENT — MARKET RESEARCH — PLANT LAYOUT and DESIGN — PACKAGE DESIGN and TESTING MANAGEMENT — PUBLIC RELATIONS — GENERAL CONSULTING — PATENTS — CHEMICAL, BACTERIOLOGICAL and NUTRITIONAL ANALYSIS

J. PAUL BISHOP AND ASSOCIATES

Consulting — *Food and Chemical* — *Engineers*

Specializing in:
Designing, Estimating and Engineering of New and Modernizing of Old Food and Chemical Plants and Processes.
Internationally Known.
Write P. O. Box 348
Champaign, Illinois

GEMAR ASSOCIATES

Consulting Materials Handling Engineers
over 20 years experience
Warehousing, Plant Layout, Production Handling
Greenwich, Connecticut, U.S.A.

SCHWARZ LABORATORIES, Inc.

Consultation on Food Problems
Analyses of Foods and Beverages
Food Plant Design and Process Improvement
Research and Investigations
Legal Testimony
Write for bulletin describing facilities and services
230 Washington St., Mount Vernon, N. Y.

BRADBURY RESEARCH ASSOC., INC.

Food Plant Consultants
PLANT SANITATION—MANDATORY LABELING, LABORATORY SERVICES; Filth in foods, food analysis, bacteriological tests.
817 Moody Street, Waltham 54, Mass.

LEWIN ASSOCIATES

Industrial Consultants
DAVID N. LEWIN, Ph.D., FOOD CONSULTANT
JOSEPH D. LEWIN, CONSULTING ENGINEER
Design — Layouts — Investigations — Consultations — Reports — Market Investigations — Bakeries, Dairy Products—Food Preserving by Heat, Drying, Freezing—Consultation in Managing, Warehousing, Distribution—Formulae, New Products.
8 West 47 St., N. Y. 36, N. Y. JUdson 6-1748

FOSTER D. SNELL, INC.

Research Chemists and Engineers
Organoleptic Panel Testing, Formulation and Stability; Protective Packaging.
Inquiries invited on food research problems.
(Official Laboratory Association of Food Distributors, Inc.)
29 West 15th Street, New York 11, N. Y.
WA 4-8800

FOOD DEVELOPMENT LABORATORY

Consulting Service
S. W. ARENSON, DIRECTOR
Service to the Baking and Potato Chip Industries
Baking, Frying, Chemical, Physical
Product Development Formulation Quality Control
1403 Eutaw Place, Baltimore, Md. — 1133 Broadway, New York, N. Y.

KARL B. NORTON & ASSOCIATES

Successors to
DONALD K. TRESSLER & ASSOC.
Food Technologists and Engineers
Specialists in Food Preparation and Preservation; Equipment Testing and Evaluation; Food Freezing; By-Product Utilization; Manufacture of Pure Fruit Flavors.
North Compo Road, Westport, Conn.

STRASBURGER & SIEGEL

Chemists - Bacteriologists—Food Technologists
Specialists in Canned and Glassed Foods
Laboratory Services
Testing Tomato Products, Mayonnaise, Pickles, Oils, Fats, Beverages, Sugars, Filth in Foods, Food and Drug Labels, Expert Testimony
1403 Eutaw Place, Baltimore 17, Maryland

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—for you—the advertiser—and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publisher to secure more advertisers and—more advertisers mean more information on more products or better service—more value—to YOU.

WHERE TO STORE FROZEN FOODS

INGREDIENTS FOR THE FOOD PROCESSOR

QUAKER CITY COLD STORAGE CO., Inc.
PHILADELPHIA, PA.
3 WAREHOUSE LOCATIONS
Proper Temperature for Frozen Foods

New Advertisements

received by October 23rd will appear in the November issue subject to limitation of space available. Address copy to the

FOOD ENGINEERING
330 W. 42nd St., New York 36, N. Y.

CARROT OIL
makes foods golden yellow

Carrot oil, like butter, contains carotene. Carrot oil is extracted from carrots, and each pound contains up to 25 million units of carotene, the international standard of vitamin A.
Carrot oil is preferred for vitaminizing foods because it is a natural vegetable oil and because it contributes vitamin A of high stability and desirable golden yellow color. Carrot oil is not synthetic, does not contain animal fats of any kind, and does not produce fishy flavor.

SEND FOR BOOKLET
New 36-page combined catalog on carrot oil for foods, feeds, and pharmaceuticals. Important reading for most food processors. Write today!

NUTRITIONAL RESEARCH ASSOCIATES
205 Broad St., South Whitley, Ind.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

$1.20 a Line—Minimum 3 Lines.
To figure advance payment count 5 average words as a line.
POSITION WANTED & INDIVIDUAL SELLING OPPORTUNITY WANTED undisplayed advertising rate is one-half of above rate, payable in advance.
PROPOSALS, $1.20 a line an insertion.

INFORMATION:

BOX NUMBERS count as one additional line.

DISCOUNT of 10% if full payment is made in advance of four consecutive insertions of undisplayed ads (not including proposals).

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

DISPLAYED RATE:

The advertising rate is $11.50 per inch for all advertising appearing on other than a contract basis. Contract rates on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

Send NEW ADVERTISEMENTS to New York City Office, 330 W. 42nd St., New York 36, N. Y., for the November issue closing October 23rd

SALES ENGINEER

Wanted immediately for customer contact work (1) evaluating processing data for canned foods and (2) technical sales problems. Education and experience in chemical engineering or food technology with mechanical aptitude, preferable under thirty. Moderate amount of travel: location Hoopeston, Illinois. Salary commensurate with experience. Send resume of education, experience, references and recent photo if available to:

Canning Machinery Division
FOOD MACHINERY AND CHEMICAL CORPORATION
HOOPESTON, ILLINOIS
Attention: Harold L. Link, *Sales Manager*

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

CHEMICAL ENGINEER required, bilingual with large experience in food canning, specially meat canning. Work will entail Management of Montreal Plant production of present manufactured goods and of future products. Salary will depend on experience and qualifications. All replies will be held confidential. P-9117, Food Engineering.

PLANT-PRODUCTION Manager required for rapidly expanding contract packager in Los Angeles, specializing in bottling and Transwrap packaging. Salary open. P-9141, Food Engineering.

PRODUCTION SUPERVISOR wanted—Must have experience in production of Baker's Specialties, Jams, Flour Mixes, Flavors, etc. Excellent opportunity with large, well established firm. Give all details training and experience, in confidence. P-9366, Food Engineering.

SELLING OPPORTUNITY OFFERED

MANUFACTURER'S SALES Representative wanted, now calling on Food and Commodity Processors, as well as general industry, to represent on a franchise commission basis, a manufacturer of Permanent Magnetic Separators. Immediate openings in City of Chicago as well as States of Illinois, Iowa, Wisconsin and Missouri. Other States will also be considered. RW-9119, Food Engineering.

EMPLOYMENT SERVICE

SALARIED PERSONNEL $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. F, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

FOOD CHEMIST: M.S., 14 years diversified experience; development and research in frozen foods, cereals, meat products. Will consider only challenging position with future. Married, veteran. PW-9137, Food Engineering.

PRODUCTION SUPERINTENDENT or Industrial Engineer—10 years diversified supervisory food plant work; Thoroughly experienced in all phases of production, engineering, quality control, and distribution; Technical College; Age 32; Family man; References; PW-9285, Food Engineering.

WE NEED!

FOOD TECHNOLOGISTS and FOOD CANNING CANDIDATES
—juniors to top-level.

Call, write or wire:
Gladys Hunting (Consultant)
Drake Personnel, Inc.
7 W. Madison St. Chicago 2, Ill.

POSITIONS WANTED

FOOD PLANT Management Executive experienced Cereals, prepared Baking Mixes, Flour, Feed, in management development & production, desires position with future. PW-9170, Food Engineering.

PLANT OR Production Manager: Experienced Branch Plant Manager of leading food company. Knows scientific management, cost, labor relations, production and distribution. B.S. Degree in Industrial Engineering. PW-8378, Food Engineering.

TECHNICIAN WITH outstanding record of accomplishments in volume production of foods, especially on controls of quality improvements, now available for similar assignments in administrative capacity. Experienced in various manufacturing fields, including frozen foods. Will relocate. PW-9078, Food Engineering.

SELLING OPPORTUNITY WANTED

REPRESENTATION IN Italy of American manufacturers of food plant & oil pressing machinery desired by distributors organization in Milan. References. Please write to RA-8943, Food Engineering.

BUSINESS OPPORTUNITY

DAIRY MANUFACTURING Plant, well equipped with stainless steel, for evaporating and condensing milk, manufacturing ice cream and mellorine mixes, manufacturing butter, in the heart of the milk, cream, and egg country within easy drive of the South's most highly populated metropolitan area, with abundant milk supply in season and good cream and egg volume throughout the year. Privately owned and for sale because wanting rest. Two boilers furnish 200 h.p.; two compressors furnish 30 tons refrigeration; two cooling towers and well. Buffalo evaporator; tubular heaters; Ford retorts; Vane Churn; Doering Printer; Morpac wrapper; C-P and C-R pasteurizers; C-P homogenizer; blower system in vaults. Ideal outlets. Wonderful plant if you can handle high volume in flush season. $100,000.00. BO-9273, Food Engineering.

WANTED

ANYTHING within reason that is wanted in the field served by Food Engineering can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

WANTED
TO EXPEDITE PRODUCTION

Food Processing Equipment including Aluminum and S/S Kettles, Mixers, Vacuum Pans, Dehydration equipment, Grinders, Elevators, Stills, Colloid Mills, Conveyors, Filters, Packaging Units, Wrapping Machines. Will consider a set up plant now operating or shut down. When offering give full particulars.

P. O. Box 1351
Church Street Sta., New York 8, N. Y.

FOOD PLANT WANTED

We are now manufacturing over $20,000,000 in various lines and wish to expand by acquisition of assets of stock of one or more industrial companies. In our negotiations the sellers' problems and wishes will receive full consideration. Present personnel will normally be retained.

Address all replies
"Confidential" C. J. GALE, Sec.
233 Broadway, N. Y. 7, N. Y. BA 7-1819

WANTED TO BUY
One Palmer Box FORMING MACHINE

W-9412, Food Engineering,
330 W. 42 St., New York 36, N. Y.

An Investment!

Productive advertising is an INVESTMENT rather than an EXPENDITURE.

"Searchlight" advertisers almost invariably report prompt and satisfactory results.

BE CONVINCED — send us your advertisement TODAY.

Address
Classified Advertising Division

FOOD ENGINEERING

330 W. 42nd St., N. Y. 36, N. Y.

MODERN REBUILT EQUIPMENT
At Tremendous Savings

UNION Rebuilt Machinery — Established 1912

International Stainless Steel Straightline Vacuum Filler, with automatic Feeder.
Resina Model LC automatic Capper.
Capem 1SF automatic Capper.
Kyler A, Burt adj. Wraparound Labelers.
Baker Perkins BB, Unidor (Vacuum) 4 to 150 gal. Double Arm Jacketed Mixers, Sigma or Fish Tail Blades.
Koven 2500 gal. Steam Jacketed Spiral Paste Mixer.
Day, Robinson Dry Powder Mixers and Sifters, 200, 600, 1300, 10,000 lbs.
Day 75 gal. Imperial, D.A. Jacketed Mixer.
850 gal. Steel Vertical S.J. Mixer.
B.P. type 3500 gal. Steam Jacketed Double Arm Mixer.
Day 650 gal. Jacketed Jumbo Mixer.
Stokes, Day, New Era, Hottman Mixers, 2 to 3500 gals. with/without Jackets, Single and Double Arm Agitators.
Fitzpatrick "D" Comminuter.
Mikro 4TH, 3TH, 3W, 1SH, Bantam Pulverizers; Schultz O'Neill Mills.
Day 40 x 120 Single Deck Sifter. Great Western—all models.
F. J. Stokes RD3 and RBB (1200 per min.) Rotary Tablet Machines.
Colton 2, 3 Rotary & 4 Tablet Machines.
Pony M Labelrite; Ermold, World semi and fully automatic Labelers.
Stokes & Smith Transwrap Filler.
S. & S. G1 and G6 Auger Fillers.
F. J. Stokes HG88 Duplex Auger Filler.
Whiz Packer and Triangle Vol. Fillers.
Triangle Package Models G1, G2C, G2S, N2CA Elec-Tri-Pak Fillers.
Horix and Elgin S. S. Rotary Fillers.
Filler 4, Hope 6 S. S. Piston Fillers.
Doughboy, Amsco Rotary Bag Sealers.
Standard-Knapp No. 429 Carton Sealer.
Hudson Sharp Campbell Cello Wrapper.
Hayssen; Package Machy. Co. FA, FA4, DF, CA2; Miller and Scandia automatic cellophane Wrappers.
Oliver 799E auto. cellophane Wrapper.
Shriver, Sweetland, Alsop Filter Presses.
Pneumatic automatic Cartoning Unit, 60 and 30 per min.

Additional Information and Prices Available on Request

UNION STANDARD EQUIPMENT CO.
318-322 Lafayette Street New York 12, N. Y.

TOP PRICES PAID FOR YOUR SURPLUS EQUIPMENT

ECH ALWAYS OFFERS UNUSUAL BUYS

SPECIAL *SPECIAL*
FMC AUTOMATIC STEAM POTATO PEELER S/S CONVEYOR BELTS. THE LAST WORD. COMPLETE UNIT. LIKE NEW.

Day 2000± Mixer, Sifter & Unloader, 20 H.P.
Niagara Whip Gyro #100 Sifter, 3 separations
General American 42" x 120" Twin Drum Dryer
United Oliver Sweetland Filter #5, 316 S/S
2200 gal. S/S Horizontal Tank, Insulated
New ±0000 Raymond Imp. Mill, with 10 HP motor
Day S.S. Jktd. Vac. Mixer, sigma arms, 5 gal.

NEW MACHINERY DIVISION
New S.S. Ribbon Mixers, all sizes.
New S.S. Tanks & Jacketed Kettles.

WHAT HAVE YOU FOR SALE?
For Better Buys & Service
Phone SOuth 8-4451—9264—8782
YOU CAN BANK ON

EQUIPMENT CLEARING HOUSE, INC.
289-10th ST., BKLYN 15, N. Y.

– FOR SALE –

1—Buflovak Type 347 Stainless Steel Rotary Vacuum Dryer, 5' x 20'.
4—Buflovak Vacuum Shelf Dryers, 20 shelves each.
1—Baker Perkins Stainless Steel Sigma Blade Jacketed Mixer, 9 gals.
1—Acme Stainless Steel Vertical Storage Tank, 12,000 gals. With coils.
1—Pfaudler Glass Lined Storage Tank, 1,000 gals.
1—Stainless Steel Crystallizing Tank, 6,000 gals.

R. GELB & SONS, INC.
Est. 1886 UNionville 2-4900 UNION, N. J.

MODERN PACKAGING EQUIPMENT
FOR IMMEDIATE DELIVERY

SPECIAL
PNEUMATIC SCALE CO. DOUBLE PACKAGE MAKER, Medium Size, Serial #9187, complete with motors. Price $1,700.00 F.O.B. our plant

PNEUMATIC SCALE CO. Automatic Cartoning Line, consisting of: Automatic Feeder, Bottom Sealer, Liner, Filler, Top Sealer & Compression Unit.
PNEUMATIC SCALE CO. Large and Small Liners.
PNEUMATIC SCALE CO. Tightwrap, High Speed.
PNEUMATIC SCALE CO.—WORLD and PONY fully automatic and semi-automatic Labelers, 60-120 per minute.
KARL KIEFER 16 Spout Stainless Steel Rotary Vacuum Filler.
PNEUMATIC SCALE CO., CONSOLIDATED AND RESINA fully automatic Cappers, 1, 3 and 4 Head.
STANDARD-KNAPP Model 429 Case Sealer and Compression Unit.
STANDARD-KNAPP Case Loader and Unloader.
STOKES & SMITH model HG84, Twin Auger Filler with Vacuum Attachment, Also Models G and GD.
PACKAGE MACHINERY Model FA Wrapper.

Partial List—send for complete list of equipment in stock.

WANTED
Single Machine or Entire Plants

ALLIED EQUIPMENT CO.
940-946 Nepperhan Ave., Yonkers 3, N. Y.
Phone: Yonkers 5-0442

FOR SALE

Bag Sealer: Amsco Hy-Speed model S.
Pulverizers: Mikro SH, 1SI, 4TH.
Reactor: 100 gallon st. steel, jacketed.
Powder Mixers: 100 to 2000 lb. capacities.
Liquid Fillers: Vacuum and Siphon types.
Mixer: Read 380 gal., st. steel, 50 hp.
Centrifugal: Sharples airtight st. steel.
Kettles: Stain. Steel, all sizes, new and used.
Filter Presses: 7, 10, 12, 24".
Screens: 18x48" Selectro, 20x81" Rotex.
Mixers: Abbe Lenart s.s. 10 and 100 gal.
Fillers: Geyer, Kiefer, Visco, M&S., Elgin.
Labelers: New Jersey, World, Knapp, Burt, Ermold.
Dough Mixers: Day, Read, Hobart, Champion.
Cappers: Capem Pneu. Scale, Elgin, U. S.
Vacuum Pans: 36" and 25 gal., st. steel.
Filters: Alsop, Ertel, Sparkler, Industrial.

Send us a list of your idle equipment

LOEB EQUIPMENT SUPPLY CO.
1931 W. North Ave. Chicago 22, Ill.

FOR SALE

3000 gal. S.S. Insulated Tank, 5'4"x19'.
4 ft. & 5 ft. Stainless Steel Vacuum Pans.
40 gal. S.S. Clad Kettle, jkt.
250 gal. S.S. Tank, 42"x42", agit.
100 to 200 gal. S.S. Mix Tanks, water jkt.
200 gal. Pfaudler Glass Lined Tanks, water jkt.
300 to 4000 gal. Glass Lined Tanks.
26" Centrifugal Extractors, 3 H.P.
125 to 1500 gal. Homogenizers or Viscolizers.
Model 148C Stokes Vacuum Pump, 1½ H.P.
3000 gal. S.S. Truck Tanks, Trailerized.
32"x90" Buflovak Double Drum Dryers.
5-Unit Room Coolers, Freon or Ammonia.
3 Ton Clark Fork Lift Truck, solid tires.
Milk Pasteurizers, Coolers, Fillers, Washers.

Send us your inquiries

LESTER KEHOE MACHINERY Corp.
1 East 42nd Street New York 17, N. Y.
MUrray Hill 2-4616

FMC

Your FIRST SOURCE *for Choice Food* EQUIPMENT

Stainless Steel Tanks - Never Used

At Way Below List Price

Complete with Agitators

5 Vertical 450 Gal. 56" x 44"
6 Horizontal 1160 Gal. 66" x 72"
11 Horizontal 2120 Gal. 76" x 100"

MIXERS

New and rebuilt ribbon type Mixers in steel and Stainless in all sizes

Heavy Duty Double Arm Mass and Do Mixers

KETTLES

New Stainless Kettles in New York stock in all sizes ready for immediate shipment. Stainless Tanks in stock at all times.

DRYERS and STERILIZERS

Buffalo and Devine Vac. Shelf Dryers from 3 shelf to 20 shelf in stock.

3 American Sterilizers 32"x48" and 42"x60" Heavy Duty Horizontal Retorts; 6'x14'

Heavy Duty Jacketed Agit. Vac. Cookers 4'x7'7"

Despatch Electrically Heated Oven or Tray Dryer 42"x58"x30" with 7 shelves

FILLERS

Horix SS 14 stem Automatic Grav-Vac. Fillers.

Kiefer Rotary Vac. Fillers up to 24 stations Ayers and Berlin Chapman S.S. Juice Fillers

M. & S. 10 Piston Stainless Steel Aut. Fillers M. & S. Piston Bronze Automatic Fillers Filler Machine Co. Piston Fillers up to 11 stations

Food Machinery S.S. Hand Pack Filler Triangle Electripak 4 Station Automatic Filler with conveyor

Stokes & Smith Model GI Auger Type Filler

Automatic Cappers by Capem, Resina, Seamers and Sealers by Max Ams; Meat Grinders, Peelers, Kraut Cutters, Dicers, Slicers, Washers.

Pulpers, Juice Extractors, Colloid Mills, and Centrifugals.

Labelers, both semi-automatic and automatic; Can Casers, Gluers and Sealers and general packaging equipment.

FRED R. FIRSTENBERG, Pres.

FIRST MACHINERY CORP.
157 Hudson Street,
New York 13, N. Y.

GOOD USED EQUIPMENT AT BARGAIN PRICES

1—Bird S.S. 48" Sus. Style Cent.
2—Blaw-Knox Jack. Autoclaves 110 Gal., 2000 psi.
4—Vert. 3500 Gal. Rubber Lined Tanks.
4—Vac. Shelf Dryers 6 to 17 Shelves.
5—Tray Dryers 16 to 250 Sq. Ft.
1—Buflovak 6' Vac. Crystallizer.
3—Stokes 212 C Vac. Pumps 100 cfm.
2—Sperry 18" C.I. Jack. Filter Presses.
10—Sperry & Shriver 12" to 30" Filter Presses.
1—Sweetland #12 Filter 72 Brze. Leaves.
1—Stainless Steel Condenser 368 Sq. Ft.
1—Horiz. 16,000 Gal. S.S. Tank 10' x 30'.
8—S.S. Jack. Kettles 125 to 300 Gals. Ag.
2—Mixers 20 Gal. Jack. D.A.—15 H.P.
1—Read 100 Gal. Jack. D.A. Mixer 40 H.P.
8—Horiz. Spiral Mixers 100 to 2000#.
1—Conveyor 24" belt x 33' Centers.
1—Clarkson Steam Generator 30 H.P. 300 psi.
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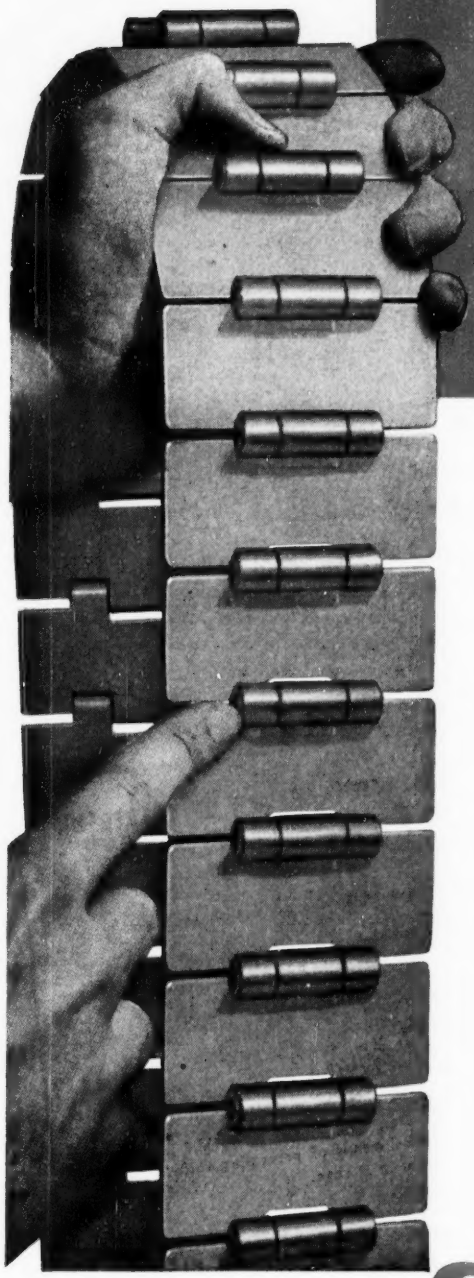

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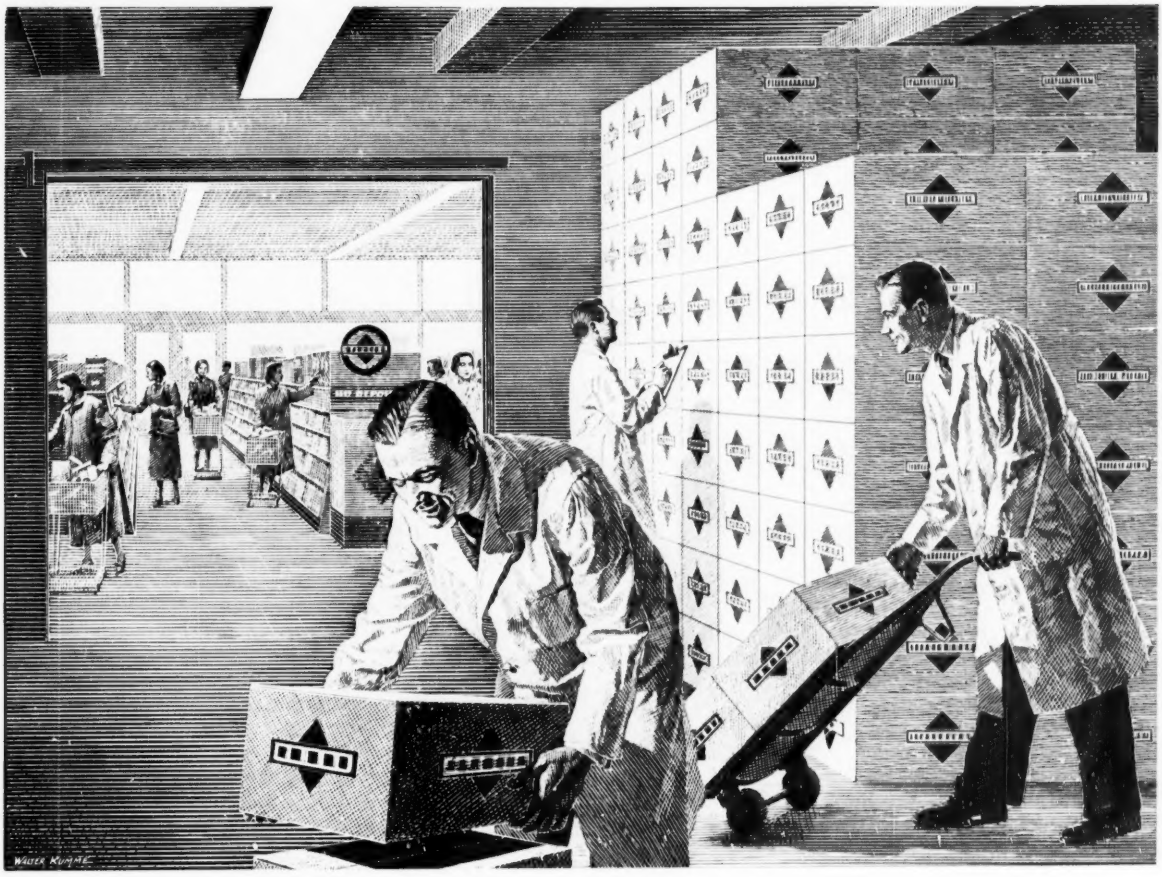
For more information, use coupon on page 207.



Your Product is Well-Dressed and "Sell-Dressed" in a Gaylord Container

Gaylord Boxes

Their unseen quality gives you an extra margin of safety.

Strikingly printed Gaylord shipping containers keep on selling your name and product wherever they go. This effective and economical medium is a natural to increase the impact of your advertising and other promotions.

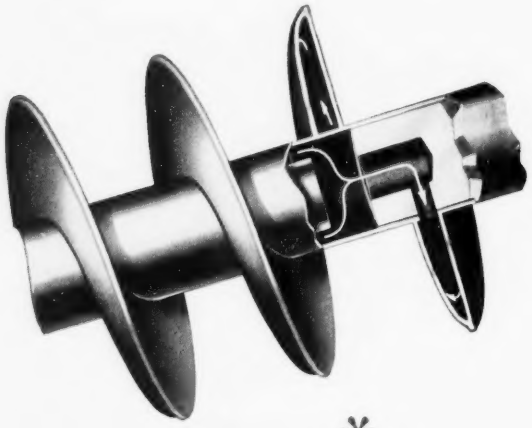
Your nearby Gaylord sales representative will be happy to tell you more about these "traveling billboards." You will find him listed under Boxes (Gaylord) in the classified pages of your phone book.

GAYLORD CONTAINER CORPORATION

General Offices: ST. LOUIS • Sales Offices Coast-to-Coast

CORRUGATED AND SOLID FIBRE BOXES • FOLDING CARTONS • KRAFT BAGS AND SACKS • KRAFT PAPER AND SPECIALTIES

A great new advancement in heat exchangers...

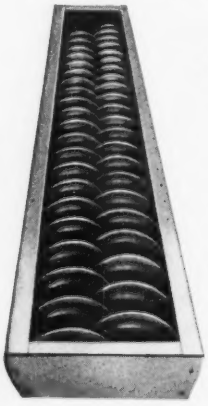


THE holo-flite* PROCESSOR
(HOLLOW-FLITE)

A simpler, more compact way to cool slurries, solids or pastes—in continuous flow!

Do you have processes where slurries, solids, pulps or pastes must be cooled or cooked? Do you know you can now handle such processes—*in continuous flow*—in as little as 1/5th the space required by other types of heat exchangers—and with many other important advantages?

The newly-developed HOLO-FLITE Processor is the answer!



what IT IS!

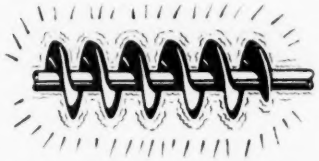
Basically the HOLO-FLITE consists of two or more flights of hollow-bladed screw conveyors. The product to be processed moves in a trough around the conveyor screws. The heat-transfer fluid circulates through the hollow blades and shafts of the conveyor. The product is constantly rotated into, around, under and over the blades and shafts through which the heat-transfer fluid is circulating, assuring quick, uniform heat passage between the two mediums—*as the product is continuously moved along in a bulk-flow without interruptions!*

Get the complete story on HOLO-FLITE *savings and how this new advancement can simplify your processing operations. It is backed by the same organization that pioneered* COTTRELL *Precipitators and* MULTICLONE *Collectors—your assurance of complete dependability.*

DETAILED INFORMATION!
New 8 page bulletin describing HOLO-FLITE features and applications will gladly be sent on request. Write, wire or phone for your free copy!

why IT'S BETTER!

The HOLO-FLITE principle provides many important advantages in modern processing operations...



ITS LARGE HEAT-TRANSFER SURFACE requires far less space—as little as 1/5th the space required by other heat-exchange equipment. Further, flights can be "stacked" as high as desired to save floor space, simplify installation!

ITS SLOW ROTATION IS SO GENTLE that granular and powdered solids are handled with no dusting—little or no particle abrasion. Result—no dust recovery problems . . . simple, inexpensive installation.

IT IS ADAPTABLE to a wide range of applications—handles solids, pulps, pastes and slurries with equal ease. Heat transfer agent can be refrigerant, water or other fluids to provide a wide range of temperatures. Cooled products can be packed directly from HOLO-FLITE discharge, saving time, space and additional handling.

IT CAN BE DESIGNED to handle virtually any capacity by varying the diameter and length of the flights, and the number of "tiers."

WESTERN
Precipitation
CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

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PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

*Reg. T. M.